Proposed Industrial Subdivision

1045 Donnybrook Drive

Preliminary

Stormwater Management Report

Project Location:

1045 Donnybrook Drive, Dorcheste, ON

Prepared for:

Lantern Capital
2425 Matheson Boulevard East, 8th Floor,
Mississauga, ON L4W 5K4

Prepared by:

MTE Consultants Inc.
123 St. George Street.
London, ON N6A 3A1

February 18, 2022

MTE File No.: 49549-100

Engineers, Scientists, Surveyors.

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1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Lantern Capital, to complete the preliminary stormwater management report for the property at 1045 Donnybrook Drive in the Town of Dorchester (Municipality of Thames Centre, County of Middlesex), Ontario. As presented on the Draft Plan of Subdivision (Zelinka Priamo, January 2022) provided in **Appendix A**, it is intended to develop the property with 11 industrial blocks, public roads and a Stormwater Management (SWM) block.

The property is located to the east of the intersection of Donnybrook Drive and Starlight Lane. The property is approximately 22.17 ha in size. The property is bounded to the north by Donnybrook Drive and existing residential properties, to the west by existing residential properties, to the east by existing commercial and agricultural properties, and to the south by Highway 401. The site location is illustrated on **Figure 1**.

This report addresses the stormwater management requirements for the proposed industrial subdivision and provides a preliminary design which meets these requirements. This report is a preliminary report for support of the draft plan application. A more detailed, final SWM report will be prepared during the future subdivision detailed engineering design process.

2.0 Criteria

The proposed stormwater management (SWM) criteria in consultation with Municipality of Thames Centre for the subject site, are as follows:

- Attenuation of the post-development peak flows for the 2-year through 100-year storm events to the pre-development (existing) peak flow rates;
- Implementation of water quality controls to provide Level 1 (enhanced) treatment levels as per the MECP SWM Practices Planning and Design Manual, 2003 (SWMPDM);

The subject development is located within the Upper Thames River Subwatershed but is not located in within area regulated by the Upper Thames River Conservation Authority (UTRCA).

3.0 Methodology

In order to successfully complete the SWM design for the development, the following specific tasks were undertaken:

- Determined the allowable/pre-development flow rates;
- Determined the percent impervious of the site and catchment area parameters for inclusion in Visual OTHYMO modelling;
- Calculated post-development runoff hydrographs using Visual OTHYMO;
- Determined preliminary SWM Pond footprint to provide required storage for SWM control (both quantity and quality); and
- Preliminary investigation of re-routing the existing municipal drains on the property to allow for the proposed development.

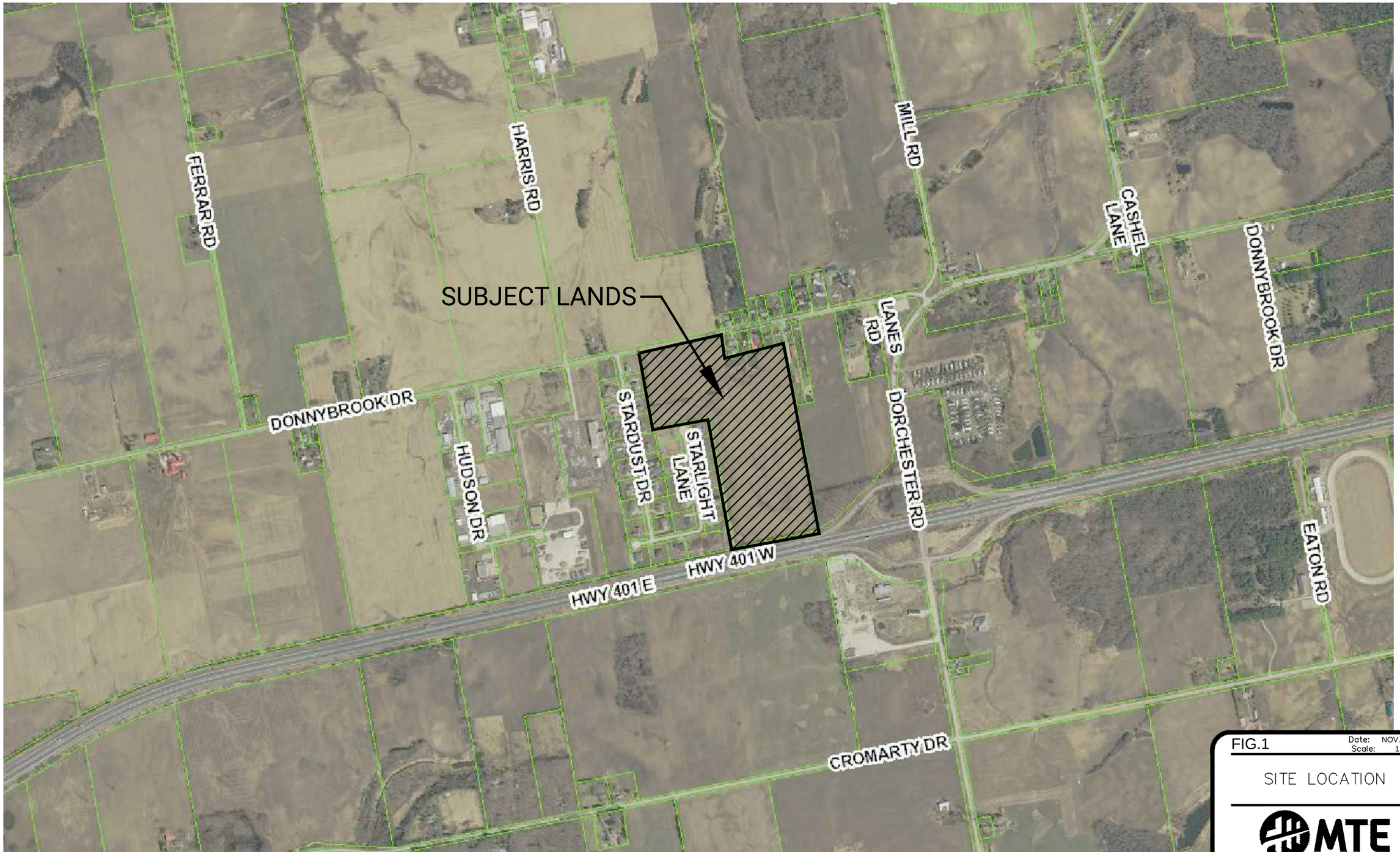

FIG.1

Date: NOV.18/21
Scale: 1:3000

SITE LOCATION

MTE

Engineers, Scientists, Surveyors

Project No.: 49549-100

4.0 Existing Conditions

A brief description of the existing drainage conditions is outlined below.

4.1 General Site information

The proposed development is located at 1045 Donnybrook Drive. The land drains to the Rath Harris Municipal Drain and to the Newton-Capstick Municipal Drain. Relevant Information for both municipal drains is provided in **Appendix B**. A preliminary geotechnical investigation was completed by Sola Engineering on June 15, 2021 (Report# 2021-15454) and is provided in **Appendix C**. A topographical survey of the site was completed by MTE on August 8, 2021.

4.1.1 Soil Information

Based on the information obtained from AG Maps (Ministry of Agriculture, Food and Rural Affairs) the local soils are determined to have hydrologic soil group (HSG) C. The preliminary geotechnical information compiled by Sola Engineering (provided in **Appendix C**) is consistent with Ag Maps.

4.2 Pre-Development Drainage

Refer to **Figure 2** for the pre-development drainage area plan. The site is currently agricultural.

Under the existing conditions, approximately 12.57 ha of the site (Catchment A01) slopes from south to the north toward the Rath Harris Municipal Drain. The drain is an open channel and conveys runoff to the north to an existing 1000 mm diameter culvert crossing under Donnybrook Drive. The drain ultimately discharges to the Dorchester Pond Drain. In addition, the external controlled flow from the adjacent Silvermoon Subdivision to the west is conveyed to Rath Harris Municipal Drain through the subject lands. The review of Silvermoon Subdivision SWM Report indicates that controlled flows to the subject land were designed to be 138 L/s for 2-year and 923 L/s for 100-year events. For more details, refer to Rath Harris Municipal Drain and Silvermoon Subdivision SWM Report, provided in **Appendix B**.

The remaining 9.60 ha lands (Catchment A02) slopes from south to east toward the Newton-Capstick Municipal Drain. The Newton-Capstick Drain consists of both a 300mm diameter tile drain and surface drainage. This drain conveys runoff to the east through the neighboring property. The drain (both 300mm diameter tile drain and surface flow) conveys runoff to the north-east through the neighbouring property, under Donnybrook Drive, under Mill Road and then joins the Lawton Municipal Drain. For more details, refer to Rath Harris Municipal Drain information, provided in **Appendix B**.

The dividing line between Rath Harris Municipal Drain and Newton-Capstick Municipal Drain was determined based on the topographic information compiled by MTE and is presented on **Figure 2.** Pre-development catchment area parameters are summarized in Table 4.1.

Table 4-1: Pre-Development Catchment Area Parameters

Catchment ID	Description	Area (ha)	Imperviousness (%)	CN Curve Number[1]
A01	Catchment Drains to Rath Harris Municipal Drain	12.57	0	83
A02	Catchment Drains to Newton-Capstick Municipal Drain	9.60	0	83
TOTAL		22.17		

[1]CN values were selected in accordance with NRCS guidelines. CN values were estimated for catchment having HSG'C' and Agricultural Land (small grains, good hydrologic condition)

4.3 Existing Hydrology

Existing hydrologic conditions were evaluated using Visual OTTHYMO 6.2 (VO2) hydrologic simulation software. The existing catchment area parameters provided in **Table 4.1** above and shown on **Figure 2** were modelled to estimate the pre-development peak flows to both the Rath Harris Municipal Drain and Newton-Capstick Municipal Drain. The 2, 5, 10, 25, 50, and 100-year storm events were all modelled using the City of London's design storm parameters with a 4-hour duration.

The pre-development conditions VO2 input parameters and corresponding model output are presented in **Appendix D**. The model results are summarized in the following table.

Table 4-2: Existing Conditions Peak Flows

Storm Event	Catchment A01 Existing Peak Flow Rates to Rath Harris Municipal Drain (m^3/s)	Catchment A02 Existing Peak Flow Rates to Newton-Capstick Municipal Drain (m^3/s)
2-year	0.321	0.247
5-year	0.336	0.259
10-year	0.454	0.351
25-year	0.607	0.468
50-year	0.686	0.561
100-year	0.852	0.658

Due to uncertainties regarding to downstream conveyance capacity of Newton-Capstick Municipal Drain, we have proposed more stringent release rates to this drain by decreasing the existing site peak flows by 20-35%. The proposed post-development target flows outlined on **Table 4-3**.

Table 4-3: Proposed Target Release Rates to Newton-Capstick Municipal Drain

Storm Event	Catchment A02 Existing Peak Flow Rates to Newton-Capstick Municipal Drain (m^3/s)	Percentage Decrease (%)	Proposed Target Release Rates to Newton-Capstick Municipal Drain (m^3/s)
2-year	0.247	20	0.198
5-year	0.259	20	0.207
10-year	0.351	20	0.281
25-year	0.468	30	0.328
50-year	0.561	30	0.393
100-year	0.658	35	0.428

Although, the Rath Harris Municipal Drain has defined surface channel downstream, the existing flow rates were decreased by 10% for each storm event to generate more stringent release rates. The proposed post-development target flows are outlined below.

Table 4-4: Proposed Target Release Rates to Rath Harris Municipal Drain

Storm Event	Catchment A01 Existing Peak Flow Rates to Rath-Harris Municipal Drain (m^3/s)	Percentage Decrease (%)	Proposed Target Release Rates to Rath-Harris Municipal Drain (m^3/s)
2-year	0.321	10	0.289
5-year	0.336	10	0.302
10-year	0.454	10	0.409
25-year	0.607	10	0.546
50-year	0.686	10	0.617
100-year	0.852	10	0.767

5.0 Proposed Conditions

The proposed development is comprised of 11 Industrial Blocks with a public road (Street 'A'). The proposed development increases the imperviousness of the site with the addition of building and hard surface coverage. Refer to the proposed Draft Plan of Subdivision provided in **Appendix A** for the proposed development layout. A stormwater management strategy was developed to accommodate the stormwater for both the proposed development and the external drainage area.

5.1 Proposed Municipal Drain Strategy

It will be necessary to reroute the Rath Harris Municipal Drain and Newton-Capstick Municipal Drain within the subject land to accommodated proposed development. These Municipal Drain alterations will be subject to the regulations of Section 78 of the Drainage Act.

The Rath Harris Municipal Drain is to be re-routed and sized to accommodate the controlled post-development flow from the neighbouring Silvermoon Subdivision (138 L/s for 2-year and 923 L/s for 100-year events). As shown on **Figure 3**, the estimated width of re-routed Rath Harris Municipal Drain is 30 m which includes allowance for grading and buffer. More information including sizing calculations for the drain channel and culvert under the Street 'A' will be provided during the future detailed design stage of the development. The existing drain outlet (1000 mm diameter culvert under the Donnybrook Drive) is to remain under the post-development conditions.

As shown on Newton-Capstick Municipal Drain plan and profiles provided in **Appendix B** there is presently a 300mm tile drain along with the junction drop structure on the development land and a catchbasin by the east property line. It is proposed to reroute the 300 mm tile drain to run along the east property line. The conveyance capacity of the rerouted drain is to be the same (or higher) as the existing drain. The need for the junction drop structure will be reviewed accordingly. Refer to **Figure 3** which shows in concept the re-routing of the drain.

5.2 Proposed SWM Strategy

The proposed SWM strategy was developed to meet Municipal, UTRCA and provincial requirements. The proposed drainage plan and SWM strategy are shown on **Figure 3**.

Based on our SWM assessment it was determined the most efficient option to provide quantity and quality control for the proposed subdivision was through the implementation of a single wet pond. Due to the existing grading constraints it is not feasible to provide outlets from the proposed SWM Pond to both the Newton-Capstick Municipal Drain and Rath Harris Municipal Drain. Therefore, it is proposed that the pond will outlet to the Rath Harris Drain only. Runoff from the site will be controlled to the target rates for the Rath Harris Drain noted in **Table 4-3**. The allowable outlet rate to the Newton-Capstick Drain will not be utilized.

Additionally, the MECP Source Protection Information Atlas shows that the Newton-Capstick. Municipal Drain has been identified as a 'WHPA Groundwater Under the Influence' (WHPA-E) area. Considering the subject site is a proposed industrial development, diverting runoff away from the Newton-Capstick Municipal Drain will be beneficial for source water protection.

Runoff from minor storm events will be collected and conveyed by proposed local storm sewers. Similarly, major flows will be conveyed to the pond block via shallow surface flow on the proposed public road. The collected stormwater will be conveyed to the proposed stormwater management facility (wet SWM pond) to control flows (both quality and quantity) before releasing to the existing Rath Harris Municipal Drain.

As shown on **Figure 3**, the post development drainage is divided to Catchment A1 (industrial development) and SWM Block Catchment A2. The total imperviousness for industrial portion was assumed to be 85%. The proposed drainage parameters are presented in **Table 5.1**, below.

Table 5-1: Post-Development Catchment Area Parameters

Catchment ID	Description	Area (ha)	Imperviousness (%)	CN Curve Number[1]
A1	Proposed Industrial Development	20.34	85	74
A2	SWM Block	1.83	0	88[2]
TOTAL		22.17		

[1]CN values were selected in accordance with NRCS guidelines. CN values were estimated for catchment having HSG'C' and lawns in good conditions
[2]CN values were increased to account for permanent pool and impervious area (access road).

Proposed hydrologic conditions were evaluated using Visual OTTHYMO 6.2 (VO2) hydrologic simulation software. The proposed catchment area parameters provided in **Table 5.1** and shown on **Figure 3** were modelled to estimate the peak flows directed to the SWM Pond (for quality and quantity control) and Pond outflows to the Rath Harris Municipal Drain. As mentioned above, due to the existing grading constraints and to protect downstream drinking water sources, there will be no outflow from the SWM Pond to Newton-Capstick Municipal Drain. The City of London design storm parameters were used to model the storm events (25mm to 100-year). Design storms were modelled as Chicago distributions with a 4-hour storm duration. In addition, the proposed pond storage was checked by using a conservative storm duration of 24-hours for the 100-year storm. The post-developmen conditions VO2 input parameters and corresponding model output are presented in **Appendix E**.

5.3 Proposed SWM Pond

The proposed SWM facility will be designed to meet the subdivision stormwater quality and quantity control requirements. The proposed facility will be designed as a wet pond in accordance with the guidance presented in the Stormwater Management Planning and Design Manual, MECP, 2003 (SMPDM).

Wet ponds consist of both permanent pool and active storage. The permanent pool (1.0 m deep) is used to provide quality control while active storage provides both water quality and quantity treatment. The SWM facility was conceptually designed with side slopes of 5:1 H:V, and an active storage depth 1.7 m. The conceptual SWM Facility footprint is shown on **Figure 3.**

5.3.1 Stormwater Management - Quality Control

Water quality control of runoff from the proposed development will be provided by the wet pond in accordance with guidance presented in the MECP SMWPDM. The proposed wet pond will provide 'Enhanced' (80% TSS removal) protection level. The preliminary permanent pool and extended detention storage volumes were estimated based on the design drainage area, the estimated impervious coverage, and the criteria presented in the MECP SMPDM, as summarized in **Table 5.2**.

Table 5-2: Water Quality Storage Requirements (MECP 2003)

Parameter	Required/Provided
Wet Pond Catchment Area	22.17 ha
Impervious Level (assumed)	85%
Protection Level	Enhanced (80% TSS Removal)
Facility Type	Wet Pond
Required Total Water Quality Control Volume[1]	250 m³/ha
Required Extended Detention Volume[2]	40 m³/ha
Required Permanent Pool Volume	**4656 m³ (22.17 ha x (250-40))**
Provided Permanent Pool Volume	**6457 m³**

[1]Determined from MECP SMPDM Table 3.2 for imperviousness of 85% for the entire drainage area of 22.17 ha (conservative approach since pond block is considered to have imperviousness of 85%).
[2]Value specified in the MECP SMPDM.

The model was used to simulate the runoff response of the developed site for the 25 mm, 4-hour water quality storm. Refer to **Appendix E** for the 25mm storm modelling results and to **Appendix F** for drawdown calculations (minimum of 24-hour drawdown was provided).

The proposed wet pond will provide the required 'Enhanced' Protection Level (80% of TSS removal) of water quality.

5.3.2 Stormwater Management - Quantity Control

The proposed pond is designed to attenuate the post–development peak discharges to below the target rates outlined in **Table 4-4**. A comparison of the target rate (pre-development) and the post-development flow rates is provided in **Table 5.3**

Table 5-3: Target Rates and Post-development (Controlled) Flow Comparison

Storm Event	Target Release Rates to Rath Harris Municipal Drain (m³/s)	Post-Development Controlled Peak Discharges to Rath Harris Municipal Drain (m³/s)
2-year	0.289	0.250
5-year	0.302	0.271
10-year	0.409	0.399
25-year	0.546	0.505
50-year	0.617	0.586
100-year	0.767	0.656

5.3.3 Preliminary Stage-Storage-Discharge Assessment

The preliminary stage-storage-discharge relationship for the proposed SWM pond is presented in the following table. Note that elevations provided in **Table 5-4** are conceptual only to confirm pond sizing. As shown in **Table 5-4** below, the proposed wet pond has sufficient capacity to provide quantity control for the 100-year storm event and provide 0.3 m of vertical free board. The complete stage-storage-discharge relationship is provided in **Appendix F.**

Table 5-4: Stage Storage Discharge Relationship

Stage (conceptual)	Permanent Pool Volume (m^3)	Active Storage Volume (m^3)	Discharge (m^3/s)	Description
275.00	0.000	0.000		Bottom of Pond
276.00	6,458	0.000		Top of Permanent Pool
276.30	6,458	2,326		
276.43	6,458	3,445	0.061	25 mm Storm WSE[1]
276.60	6,458	4,844		
276.90	6,458	7,558		
277.20	6,458	10,474		
277.27	6,458	11,166	0.658	1:100-Year WSE[1]
277.30	6,458	11,492		
277.60	6,458	14,686		
277.70	6,458	15,798		Top of the Pond

[1]WSE denotes conceptual water surface elevation.

APPROX. LOCATION OF EX. CB
(TO BE CONFIRMED)

APPROX. LOCATION OF NEWTON
CAPSTICK DRAIN –300mm TILE DRAIN

EXISTING RATH HARRIS
DRAIN–SURFACE CHANNEL

DONNYBROOK ROAD

HIGHWAY 401

SILVERMOON SUBDIVISION

STARLIGHT LANE

A01
12.57 0%

A02
9.60 0%

KEY

A01 — AREA NUMBER
1.00 0% — IMPERVIOUS AREA
AREA (IN ha)

CATCHMENT AREA

MAJOR OVERLAND FLOW

EX. MUNICIPAL DRAINS

FIG.2

Date: NOV.18/21
Scale: 1:2000

PRE–DEVELOPMENT
DRAINAGE AREA

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Project No.: 49549-100

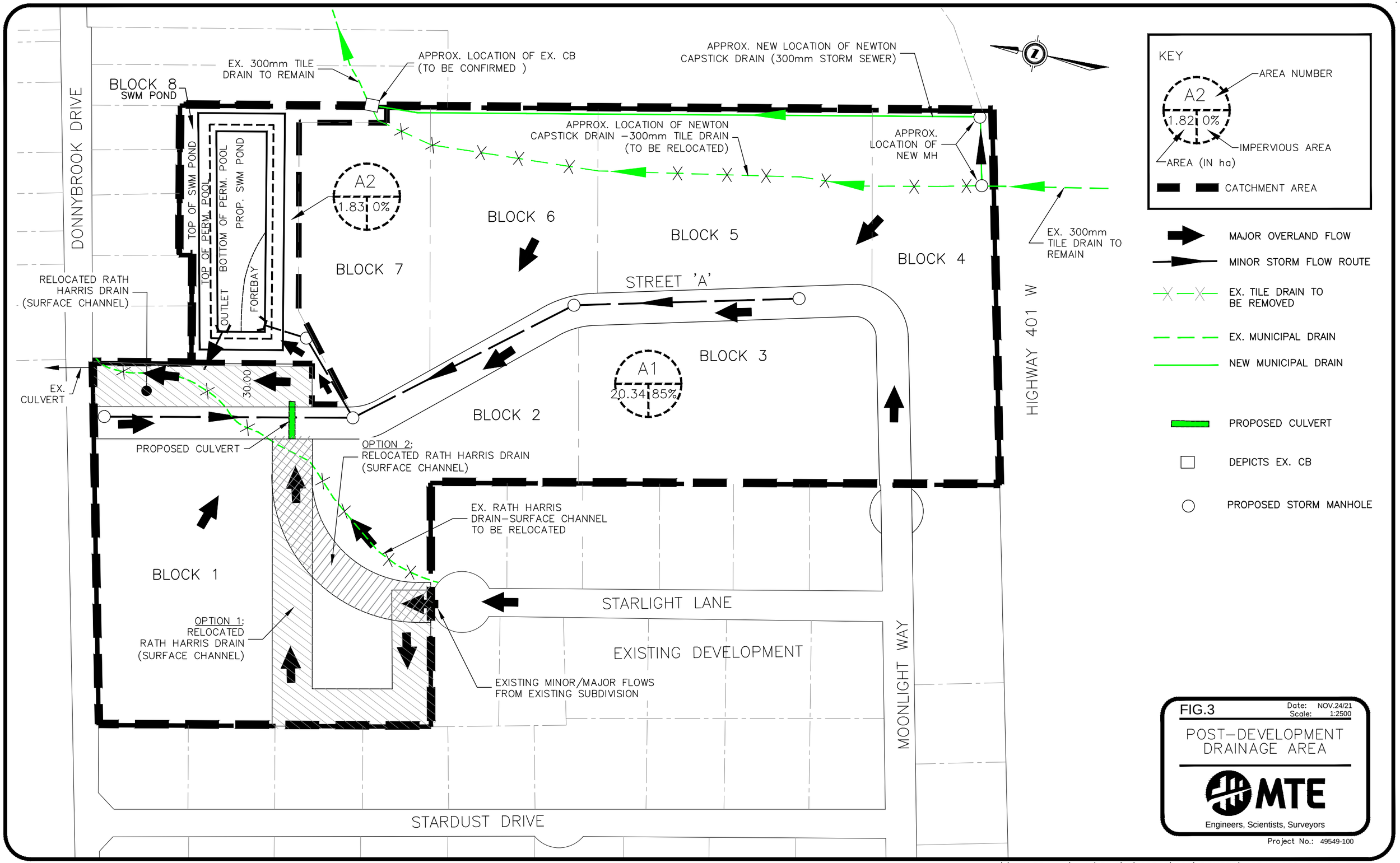

FIG.3 Date: NOV.24/21 Scale: 1:2500

POST–DEVELOPMENT DRAINAGE AREA

MTE Engineers, Scientists, Surveyors

Project No.: 49549-100

\\mte85.local\mte\DWG\P\49549\100\FIGURES\49549–100–FIGURE 3.dwg

6.0 Conclusions and Recommendations

Based on the foregoing analysis, it is concluded that:

i. The presented preliminary stormwater management strategy will meet the corresponding local and provincial stormwater management policies such that the development will not result in adverse stormwater impacts on the downstream lands.

ii. The preliminary SWM wet pond design provides post-development peak flow attenuation to below the pre-development levels and will provide quality control to achieve 'Enhanced' Protection Level water quality treatment.

iii. As outlined, this report is a preliminary SWM report for support of the draft plan application. A more detailed, final SWM report will be prepared during the future subdivision detailed engineering design process.

All of which is respectfully submitted,

MTE Consultants Inc.

Dragan Sredojevic, P.Eng., M.E.Sc.
Design Engineer
519-204-6510 ext. 2286
dsredojevic@mte85.com

DXS:cmg

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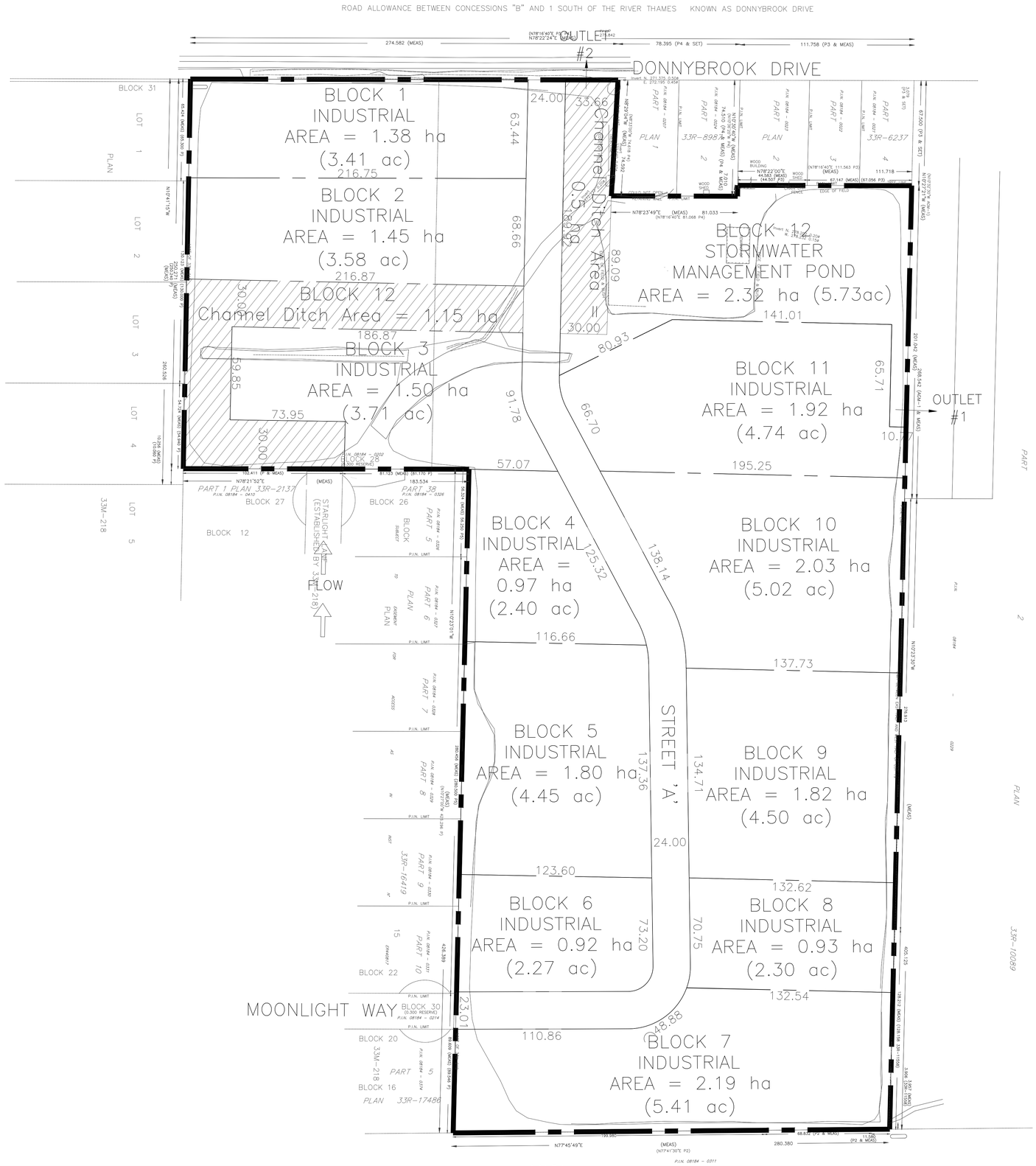
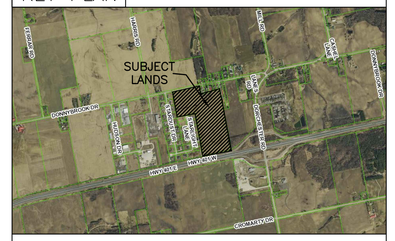
Appendix A

Draft Plan of Subdivision



KEY PLAN



DRAFT PLAN OF SUBDIVISION

OF PART OF

CON 1 SRT PT LOTS 19,20

TOWN OF DORCHESTER
COUNTY OF MIDDLESEX

INFORMATION REQUIRED UNDER SECTION 51 (17) OF THE PLANNING ACT

A) As shown	G) As shown
B) As shown	H) Municipal water supply available
C) As shown	I) Mix of Silty Sand & Silty Clay
D) As listed above	J) As shown
E) As shown	K) All municipal services to be available
F) As shown	L) As shown

PROPOSED LAND USES AND AREAS

INDUSTRIAL (BLOCKS 1-11)	17.31ha
STORMWATER MANAGEMENT (12&13)	3.47 ha
ROADS	1.39 ha
TOTAL	22.17 ha

OWNER'S CERTIFICATE

LANTERN CAPITAL
HEREBY CONSENTS TO THE FILING OF THIS PLAN IN DRAFT FORM

LANTERN CAPITAL, OWNER — DATED

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY SHOWN ON THIS PLAN.

ONTARIO LAND SURVEYOR — DATED

NO.	REVISION	DATE	INITIAL

1045 DONNYBROOK DRIVE

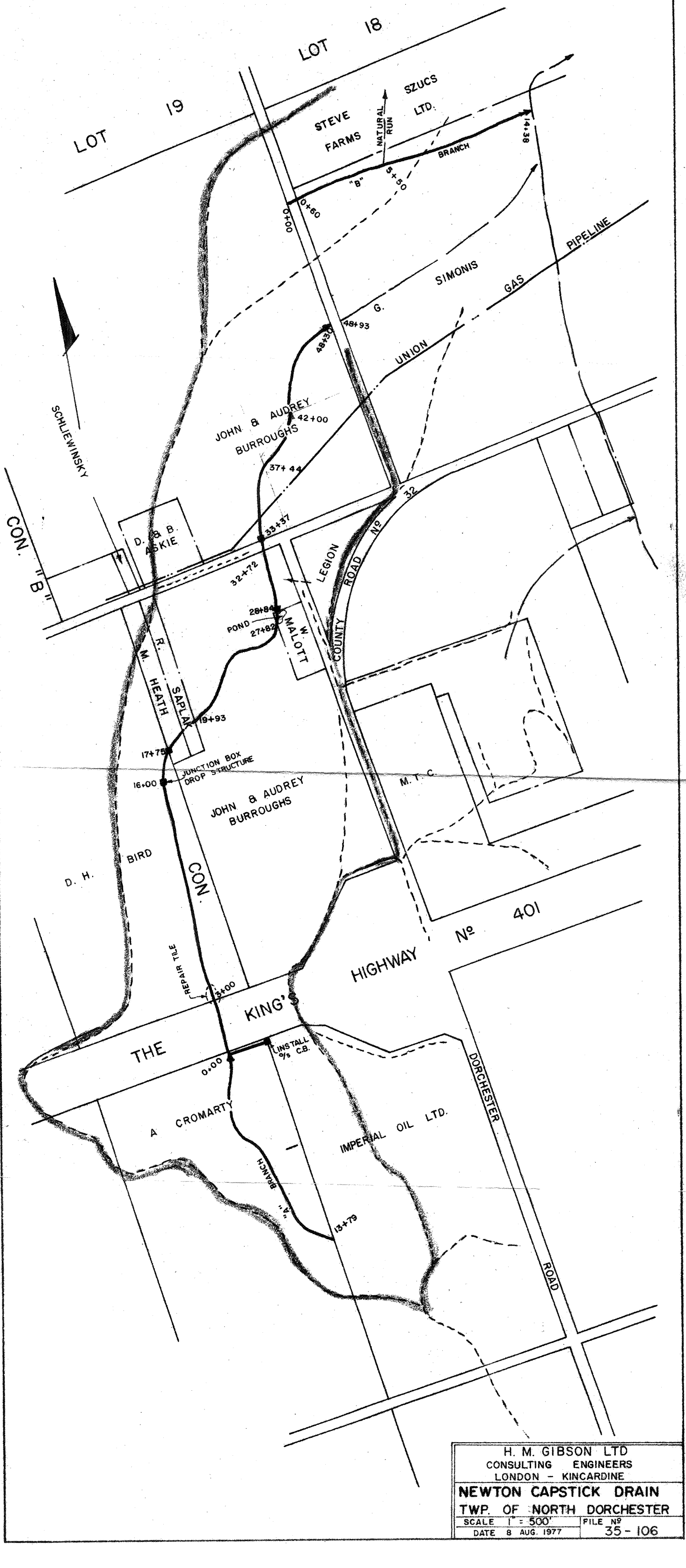
LANTERN CAPITAL

ZELINKA PRIAMO LTD
A Professional Planning Practice
318 Wellington Road, London, Ontario N6C 4P4
Tel: (519) 474-7137 Fax: (519) 474-2284 e-mail: zp@zpplan.com

DRAWN BY	PROJECT NO.
KC	LNT/THC/21-01
DATE	SCALE
JANUARY 2022	1:1,350

Appendix B

Existing Municipal Drain Information and Existing Silvermoon Subdivision SWM Report

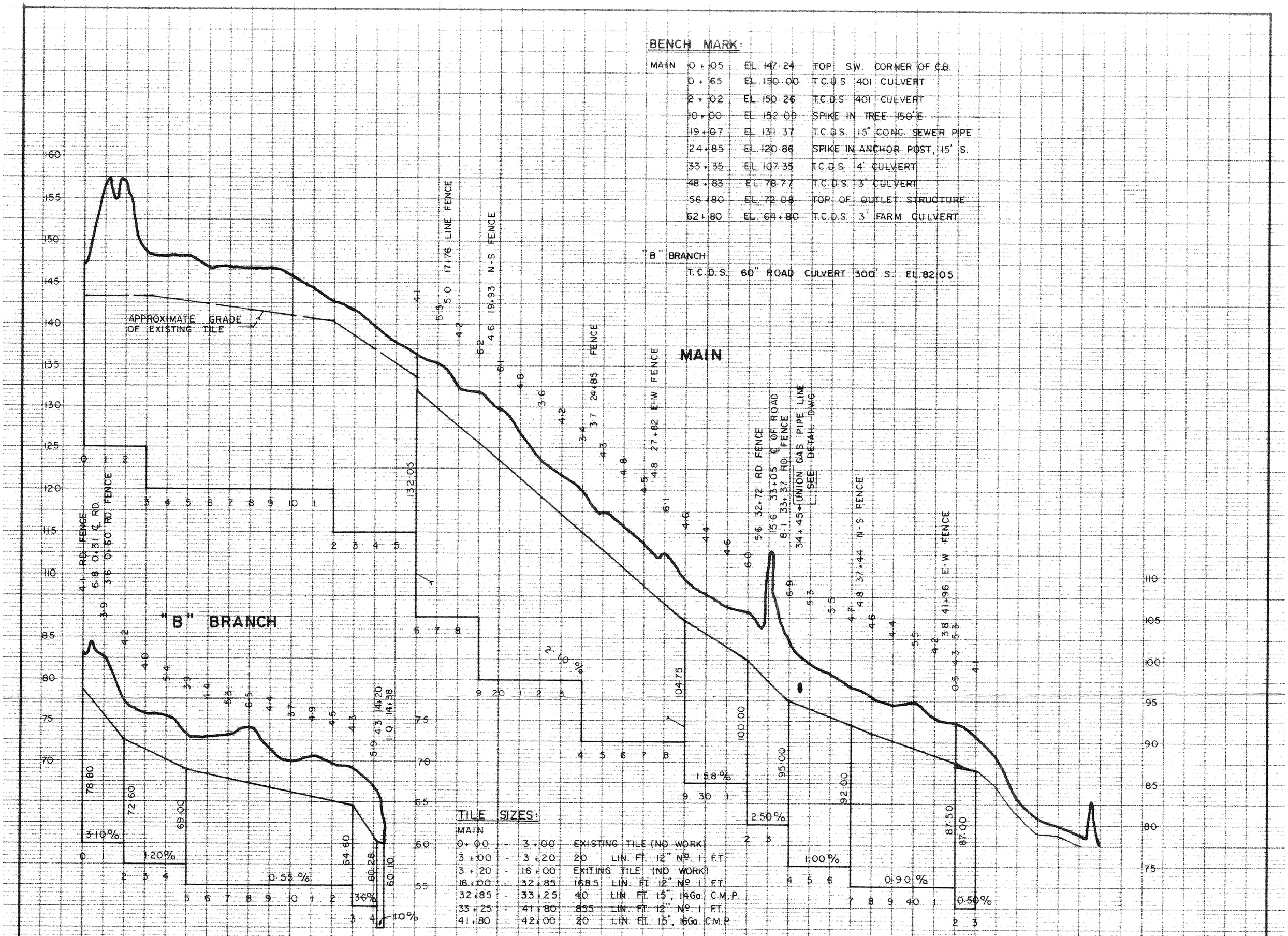


H. M. GIBSON LTD
CONSULTING ENGINEERS
LONDON - KINCARDINE

NEWTON CAPSTICK DRAIN

TWP. OF NORTH DORCHESTER

SCALE 1" = 500'	FILE No
DATE 8 AUG. 1977	35 - 106



BENCH MARK:

MAIN	0+05	EL. 147.24	TOP S.W. CORNER OF C.B.
	0+65	EL. 150.00	T.C.U.S. 40I CULVERT
	2+02	EL. 150.26	T.C.D.S. 40I CULVERT
	10+00	EL. 152.09	SPIKE IN TREE 150' E
	19+07	EL. 131.37	T.C.D.S. 15" CONC. SEWER PIPE
	24+85	EL. 120.86	SPIKE IN ANCHOR POST, 15' S.
	33+35	EL. 107.35	T.C.D.S. 4' CULVERT
	48+83	EL. 78.77	T.C.D.S. 3' CULVERT
	56+80	EL. 72.08	TOP OF OUTLET STRUCTURE
	62+80	EL. 64.80	T.C.D.S. 3' FARM CULVERT

"B" BRANCH

T.C.D.S. 60" ROAD CULVERT 300' S. EL. 82.05

TILE SIZES:

MAIN

0+00	- 3+00	EXISTING TILE (NO WORK)		
3+00	- 3+20	20	LIN. FT.	12" N° 1 F.T.
3+20	- 16+00	EXITING TILE (NO WORK)		
16+00	- 32+85	1685	LIN. FT.	12" N° 1 F.T.
32+85	- 33+25	40	LIN. FT.	15", 14Ga. C.M.P.
33+25	- 41+80	855	LIN. FT.	12" N° 1 F.T.
41+80	- 42+00	20	LIN. FT.	15", 16Ga. C.M.P.

CATCH BASINS STA. 17+76, 28+84 & 32+72 DITCH INLET TYPE

JUNCTION BOX DROP STRUCTURE STA. 15+00 2 x 2'

CLEARING WIDTHS

OPEN DITCH - SUFFICENT TO PERMIT CONSTRUCTION AND LEVELLING OF SPOIL

TILE DRAIN - 50' ON EACH SIDE OF DRAIN - EXCEPT WILLOWS WHICH SHALL BE CLEARED 100' ON EACH SIDE OF DRAIN

"B" BRANCH

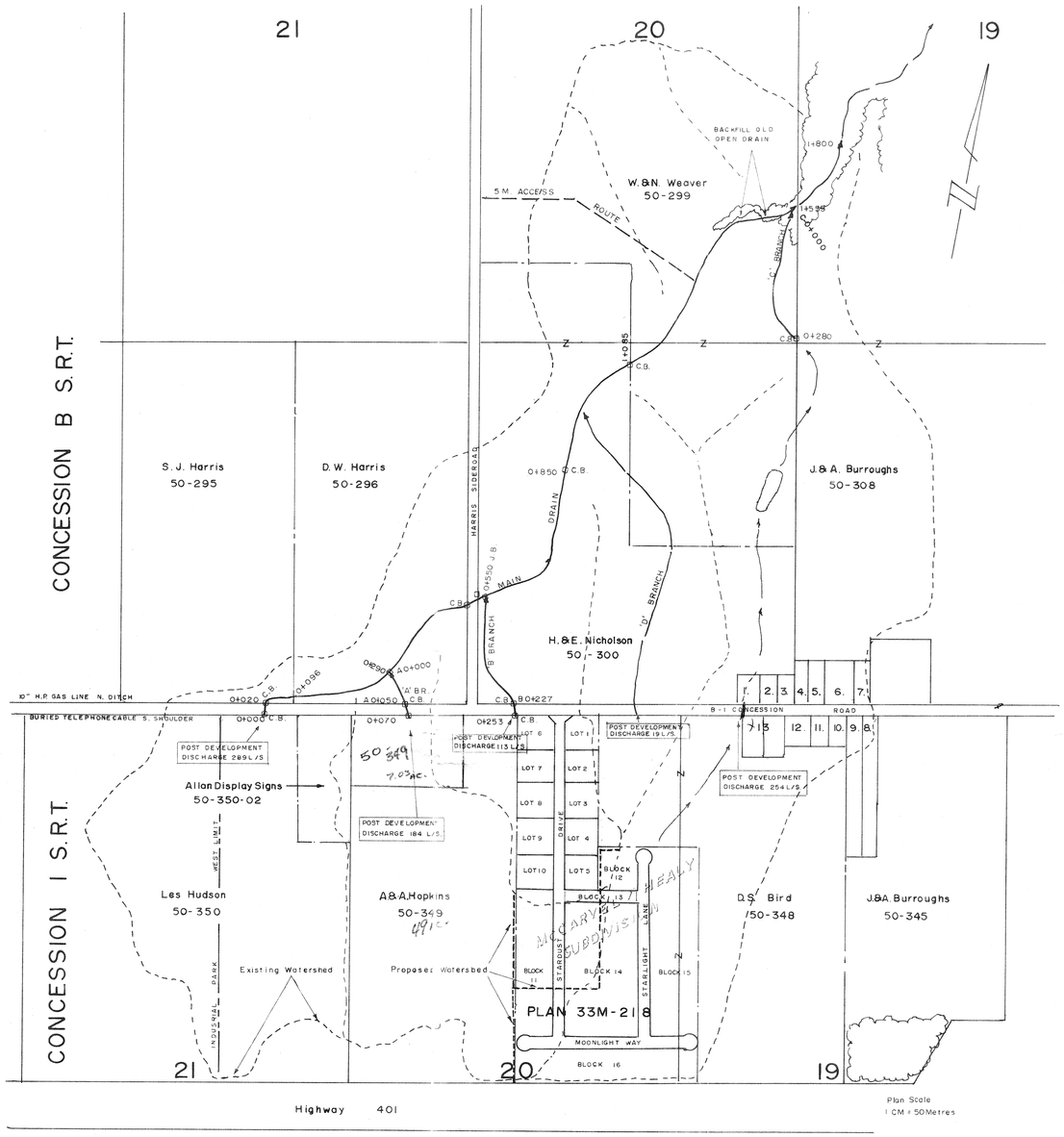
0+00	- 0+50	50	LIN. FT.	8", 16Ga. C.M.P. PERF.
0+50	- 14+20	1370	LIN. FT.	6" N° 1 F.T.
14+20	- 14+40	20	LIN. FT.	8", 16Ga. C.M.P.

CATCH BASIN 0+00 BLIND INLET 0+10

NEWTON CAPSTICK
REPAIR & IMPROVEMENT MUNICIPAL DRAIN
TOWNSHIP OF NORTH DORCHESTER

H. M. GIBSON LTD.
CONSULTING ENGINEERS
LONDON - KINCARDINE

DESIGN BY R.B.H.	REVISED: 20 JAN. 1978
DRAWN BY R.D.E.	CHECKED BY H.M.G.
SCALE HORIZ 1" = 400' VERT 1" = 10'	FILE N°. 35 - 106
DATE 8 AUGUST 1977	



1	50-300-01	P.& S. Nicholson	
2	50-301	W.& I. Laidlaw	
3	50-302	W.& B. Bell	
4	50-303	H. Schliewinsky	
5	50-304	R.& W. Anderson	
6	50-305	P.& S. Baker	
7	50-306	G.& I. Schliewinsky	
8	50-346	S.D. Driver	
9	50-347	J.& K. McConnell	
10	50-347-02	J.& J. Perkins	
11	50-347-04	J.& A. Drake	
12	50-347-06	N.L. Bird	
13	50-347-08	J.& S. Teeple	

McCarvel/Healy Subdivision
Plan 33M-218

Lot 1	50-348-12	722998 Ontario Ltd.
Lot 2	50-348-14	" " "
Lot 3	50-348-18	Jack Baribeau
Lot 4	50-348-20	M.Matte & G.Bernardi
Lot 5	50-348-22	Frank Prato
Lot 6	50-348-52	722998 Ontario Ltd.
Lot 7	50-348-54	D.& R. Melvin
Lot 8	50-348-56	722998 Ontario Ltd.
Lot 9	50-348-58	D.LaRose & E. Allender
Lot 10	50-348-60	722998 Ontario Ltd.
Blk 11	50-348-92	722998 Ontario Ltd.
Blk 12	50-348-56	" " "
Blk 13	50-348-24	" " "
Blk 14	50-348-28	" " "
Blk 15	50-348-52	" " "
Blk 16	50-348-64	" " "

TILE SIZES

Main Drain

0+000 - 0+020	20 Lin. M.	700 mm. dia. 2.0 mm. wall c.m.p.
0+020 - 0+290	270 Lin. M.	600 mm. dia. concrete drain tile
0+290 - 0+512	222 Lin. M.	675 mm. dia. concrete drain tile
0+512 - 0+530	18 Lin. M.	750 mm. dia. 2.0 mm. wall c.m.p.
0+530 - 1+085	555 Lin. M.	675 mm. dia. concrete drain tile
1+085 - 1+549	464 Lin. M.	750 mm. dia. concrete drain tile
1+549 - 1+555	6 Lin. M.	1000 mm. dia. 1.6 mm. wall c.m.p.

Branch A

0+000 - 0+050	50 Lin. M.	300 mm. dia. concrete drain tile
0+050 - 0+070	20 Lin. M.	375 mm. dia. 2.0 mm. wall c.m.p.

Branch B

0+000 - 0+227	227 Lin. M.	300 mm. dia. concrete drain tile
0+227 - 0+253	26 Lin. M.	375 mm. dia. 2.0 mm. wall c.m.p.

Branch C

0+000 - 0+006	6 Lin. M.	700 mm. dia. 1.6 mm. wall c.m.p.
0+006 - 0+280	274 lin. M.	525 mm. dia. concrete drain tile

CATCHBASINS and JUNCTION BOXES

Main Drain

900 mm X 1200 mm inline ditch inlet catchbasins - 0+000, 0+020, 0+513, 0+850, & 1+085.
600 mm X 600 mm offset ditch inlet catchbasin - 0+530
900 mm X 1200 mm junction boxes - 0+290 & 0+550

Branch A

900 mm X 1200 mm inline ditch inlet catchbasin 0+070
600 mm X 600 mm offset ditch inlet catchbasin 0+050

Branch B

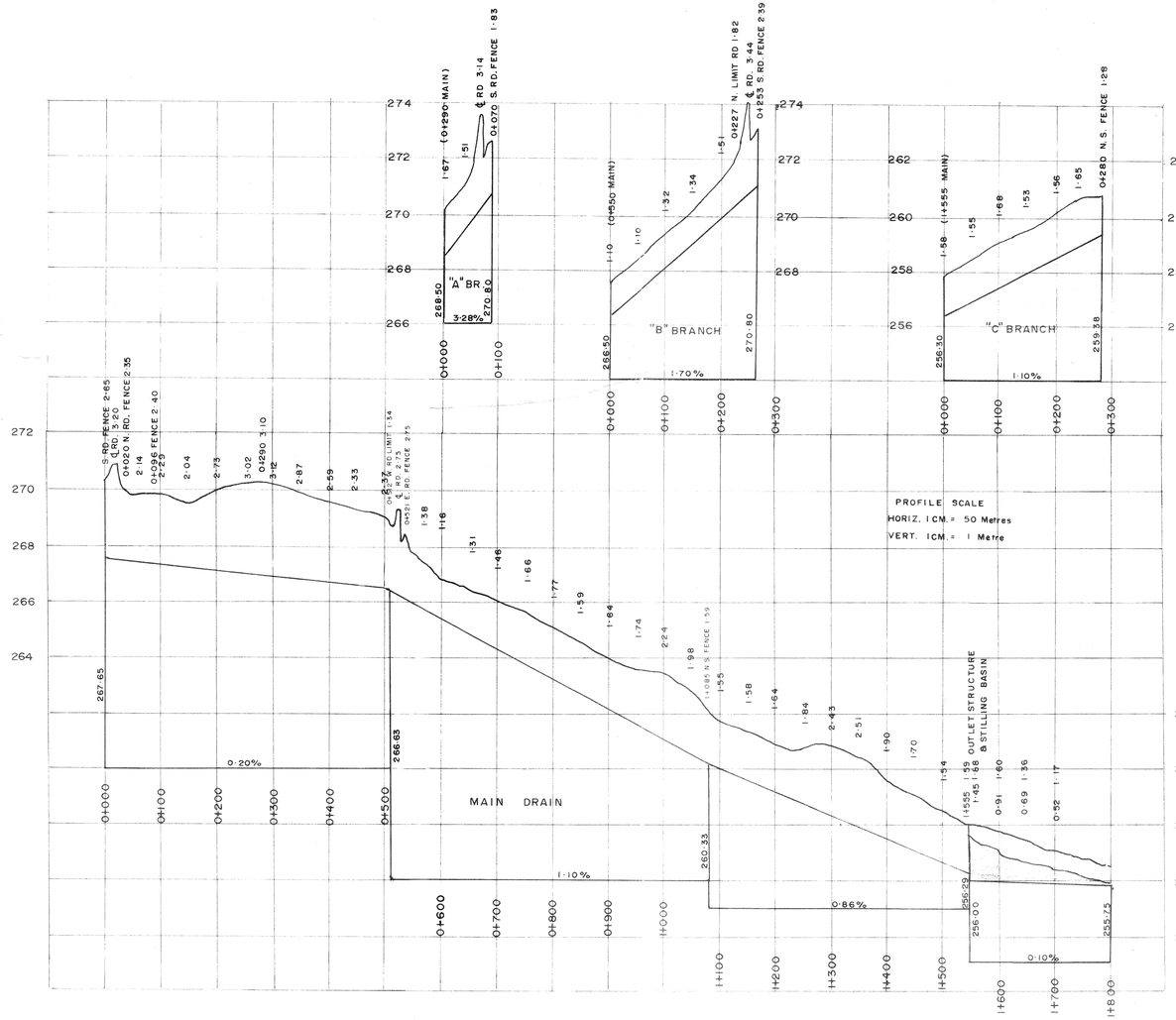
900 mm X 1200 mm inline ditch inlet catchbasin 0+253
600 mm X 600 mm offset ditch inlet catchbasin 0+227

Branch C

900 mm X 1200 mm inline ditch inlet catchbasin 0+280

NOTES

1. Deep Excavation: Station 0+020 to station 0+513 will require compaction of backfill as noted on the accompanying detail drawings.
2. Stripping of Topsoil: In areas requiring stripping of topsoil, station 0+150 to station 0+450, 0+550 to 1+050 and 1+225 to 1+375, the topsoil shall be stripped, stockpiled, and replaced after the tile have been installed. The stripped area shall not be less than 10 metres in width.
3. Wrapping of Joints: All tile joints shall be completely wrapped with a double layer of geotextile filter fabric. The joint wrap shall be not less than 40 cm. in width and shall overlap at the ends not less than 40 cm.
4. Rip Rap:
Catchbasin protection - 300mm dia. 20 cubic metres.
Stilling Basin - 350 mm. dia. 33 cubic metres.



BENCH MARKS

Main Drain

0+018	Spike in hydro pole 25 M. East	270.38
0+530	Spike in hydro pole 10 M. North	268.99
0+850	Spike in 600 mm. dia. Ash tree 30 Meters West	265.76

A Branch

0+050	Spike in hydro pole 10 M. East	272.86

B Branch

0+227	Spike in hydro pole 5 M. East	273.61

C Branch

0+280	Spike in 650 mm dia. Maple 40 Metres North.	261.31

WORKING SPACE

The working space for the construction, maintenance and repair shall be an average width of 20 metres along the course of the drain excepting from 0+150 to 0+450, 0+550 to 1+050 and 1+225 to 1+375 where the width shall be 35 Metres.

Access to the working space shall be gained from the Harris sideroad, the Concession road and via the 5 metre wide access route shown on the plan.

SEED MIX

Kentucky Tall Fescue	30 Kg. / Ha.
Birdsfoot Trefoil	20 Kg. / Ha.
10:10:10: Fertilizer	450 Kg. / Ha.

CLEARING

All trees, brush, logs and stumps shall be cleared back an average width of 25 metres. All trees larger than 150mm. (6") in dia. shall be cut and piled for the use or disposal by the owner. No cleared material to buried by spoil.

NO.	REVISION	BY	DATE

REGISTERED PROFESSIONAL ENGINEER 5/10/89 W. J. BARTLETT PROVINCE OF ONTARIO

W. J. BARTLETT & ASSOCIATES LTD.
CONSULTING CIVIL ENGINEERS
DORCHESTER 519-268-7091 ONTARIO

DESIGN	R. B. H.
CHECKED	W. J. B.
DRAWN	R. B. H.
SCALE	AS NOTED

RATH-HARRIS
MUNICIPAL DRAIN IMPROVEMENT
TOWNSHIP OF NORTH DORCHESTER
PLAN AND PROFILE

DATE: SEPTEMBER 14, 1989
SHEET: 1 OF 3
FILE NO. 890906-9

SILVERMOON SUBDIVISION

STORMWATER MANAGEMENT REPORT

FOR

980238 Ontario Ltd.

and

Anand Investments Ltd

June 17, 2004

TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

The proposed development occupies 8.40ha in Dorchester, Ontario and is known collectively as Part of Block 14, Block 15, and Block 16, Plan 33M-218. The site is bounded by Hwy. 401 to the south, Stardust Drive to the west and Donnybrook Drive to the North.

The development known as "Silvermoon Subdivision" will be comprised of 16 lots. Storm Drainage is to be conveyed by road side ditch, which ultimately discharges at the northeast corner of the site. Sanitary servicing will be provided by way of septic system on each lot with water supplied by well. Mainline Hydro, Bell and cable will be on poles along the right of way with underground servicing. Buried gasmain will also be installed to service each lot.

2.0 STORMWATER MANAGEMENT PLAN

2.1. Stormwater Management Criteria

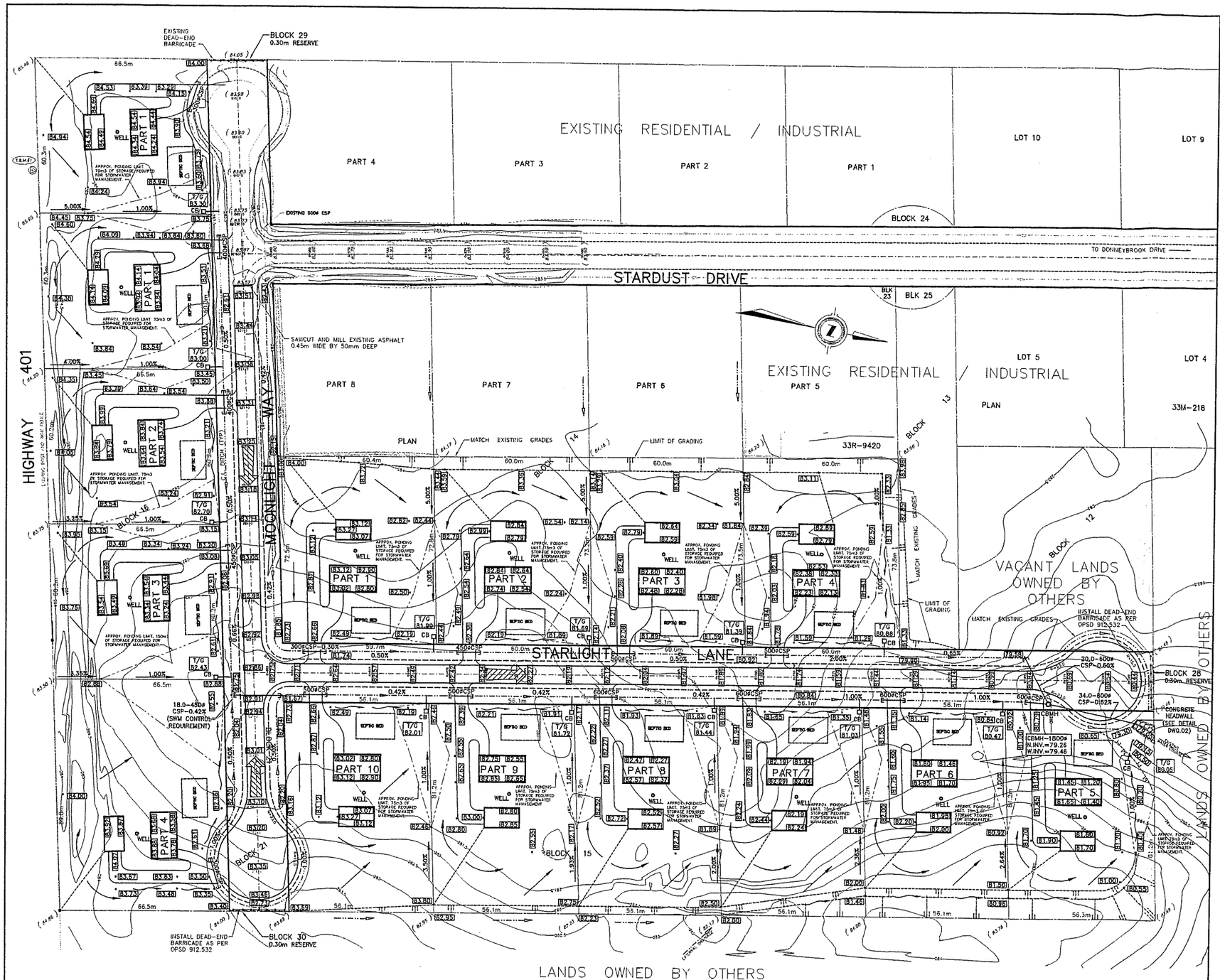
The design of the proposed stormwater management measures follow criteria presented in The Ministry of the Environment's *Stormwater Management Practices Planning and Design Manual* (2003).

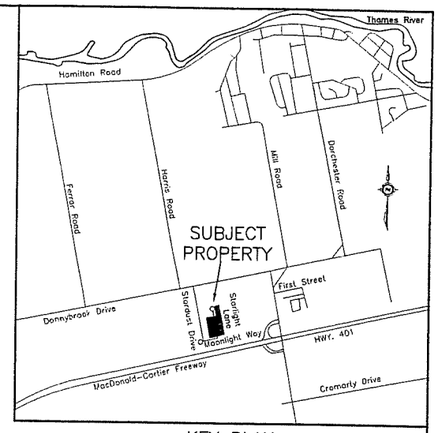
Stormwater flows for the site will be restricted to predevelopment levels from the 2-year to 100-year storm event by way of lot level controls for the 2 year storm and a combination of lot level controls and roadside ditch controls for the 100 year storm.

2.2. Site Design and Stormwater Management

Grading for each lot will be such that storm flows are directed toward a surface storage swale on the low-lying side of the lot, which is to be sized to provide 75 cubic metres of surface storage. An orifice plate placed on the outlet pipe in each catchbasin located at the end of each storage area will control flow to the road side ditch during the 2 year storm. A goss trap shall be installed on each catchbasin to prevent clogging of the orifice. Flows in excess of the 2 year storm will overtop the lot storage areas to the road side ditch. Road culverts and driveway culverts have been sized to restrict flows to predevelopment levels during the 100 year storm, thereby using the road side ditches for storage. The site grading plan has been enclosed (Figure 1)

The cumulative storage volumes achieved by lot level storage is sufficient to control the 2 year storm to the predevelopment level. For the 100 year storm, control is achieved by a combination of lot level storage and road side ditch storage in order to restrict flows to predevelopment levels.





KEY PLAN
NOT TO SCALE

EROSION & SEDIMENTATION CONTROL NOTES:

1. PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
2. ALL EROSION CONTROL MEASURES TO BE IN PLACE BEFORE STARTING CONSTRUCTION AND REMAIN IN PLACE UNTIL RESTORATION IS COMPLETE.
3. MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION.
4. ALL COLLECTED SEDIMENT TO BE DISPOSED OF AT AN APPROVED LOCATION.
5. MINIMIZE AREA DISTURBED DURING CONSTRUCTION.
6. ALL DEWATERING TO BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN.
7. PROTECT ALL CATCHBASINS AND MANHOLES FROM SEDIMENTATION INTRUSION WITH GEOTEXTILE (TERRAFIX SILT SACK OR APPROVED EQUIVALENT).
8. MAINTAIN DEPRESSED AREA AROUND CATCHBASINS DURING CONSTRUCTION TO PROTECT FROM SEDIMENTATION INTRUSION.
9. KEEP ALL SUMPS CLEAN DURING CONSTRUCTION.
10. PREVENT WIND-BLOWN DUST.
11. ALL OF THE ABOVE NOTES AND ANY SEDIMENT & EROSION CONTROL MEASURES ARE AT THE MINIMUM TO BE IN ACCORDANCE WITH THE MINISTRY OF NATURAL RESOURCES GUIDELINES ON EROSION AND SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES.

LEGEND

- OVERLAND FLOW ROUTE
- T/G 00.00 — PROPOSED TOP OF GRATE ELEVATION
- 83.75 — PROPOSED FINISHED GROUND ELEVATION
- (83.00) — EXISTING ELEVATION
- ICB. — PROPOSED CURB INLET CATCHBASIN
- CB. — PROPOSED CATCHBASIN
- CBMH. — PROPOSED CATCHBASIN MANHOLE
- DICB. — PROPOSED DITCH INLET CATCHBASIN
- EXISTING CURB INLET CATCHBASIN
- EXISTING CATCHBASIN
- EXISTING CATCHBASIN MANHOLE
- EXISTING DITCH INLET CATCHBASIN
- 600ø CSP — PROPOSED CSP CULVERT

BENCHMARK

MTO MONUMENT 66-38
NORTH SIDE OF HIGHWAY 401, APPROXIMATELY 45m EAST OF THE WEST LIMIT OF THIS SUBDIVISION.
ELEVATION 285.923

NOTE:

ADD 200 METRES TO OBTAIN GEODETIC DESIGN ELEVATIONS.

AS CONSTRUCTED NOTES	AS CONSTRUCTED SERVICES	COMPLETION

DESIGN	JRH SPB
DRAWN	GSB \ FMV
CHECKED	DTH
APPROVED	SPB
DATE	JUNE 18 2004

NO	REVISIONS	DATE	BY

CONSULTANT OF DIVISION
AGM SURVEYING • ENGINEERING
ARCHIBALD, GRAY & McKAY ENGINEERING LTD.
LONDON 685-5300

ENGINEER'S STAMP

980238 Ontario Ltd.
and
Anand Investments Ltd.

SCALE: NTS

TITLE: SILVERMOON SUBDIVISION
LOT GRADING PLAN
AND EROSION & SEDIMENTATION CONTROLS

PROJECT No: 1133-1/1135-1
SHEET No: 01
PLAN FILE No:

Plot date: Jun 18, 2004 G:\CLIENT\1133\1\DWG\1133-1135-1ASE.dwg

2.2.1. Hydrologic Modeling

Stormwater runoff rates were determined by hydrologic modeling using MIDUSS (Microcomputer Interactive Design of Urban Stormwater Systems). This program allows the user to test the impact on new and existing systems, utilizing accepted rainfall data to represent design storms of various durations. The 2 year storm event and 100 year storm events were used to model the site for peak flow control. Modeling parameters used can be seen in Appendix A.

The model was first run to determine the predevelopment flow from the site. Based on a total drainage area of 10.57 ha, the peak runoff from the 2 year storm is .138 cubic metres per second (138 l/s). The peak runoff from the 100 year storm is .923 cubic metres per second (923 l/s). A schematic of the model can be seen in Figure 2. The predevelopment catchment plan, modeling data and output can be seen in Appendix B and Appendix C for the 2 year and 100 year storms respectively.

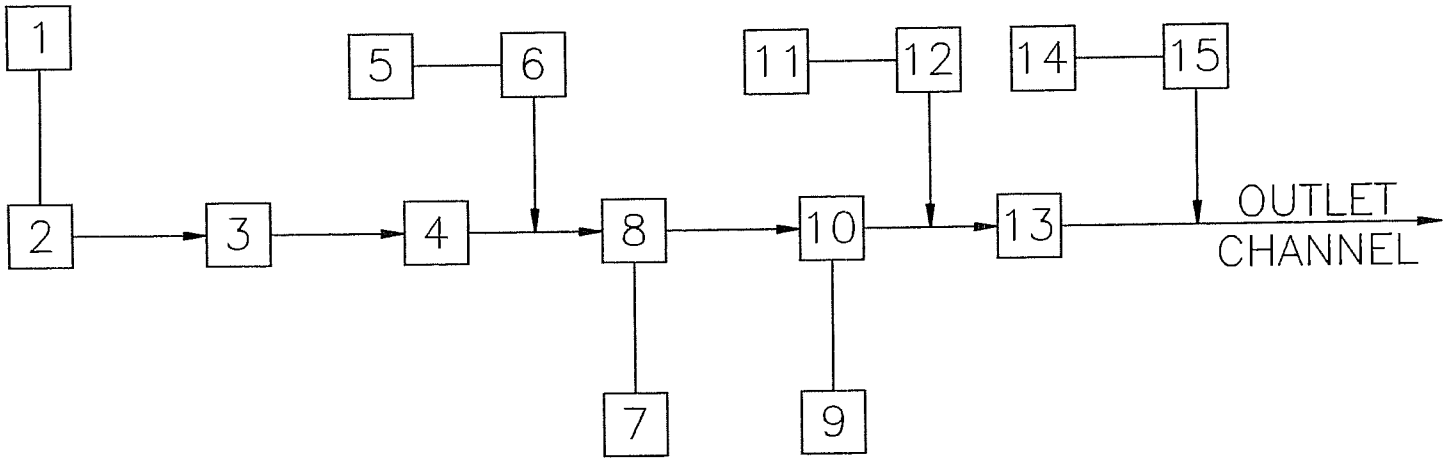
The model was run several times with various ditch storage volumes, and outlet controls (orifice, culverts) until a combination was determined that limited peak storm flows to the predevelopment level for the 2 year and 100 year storm events. A schematic of the model can be seen in Figure 3. The post development catchment plan, modeling data and output can be seen in Appendix D and E for the 2 year and 100 year storms respectively.

2.2.2. Outlet Controls

The first level of control is provided by surface storage on each lot within the development. Each lot is to provide a total of 75 cubic metres of storage. A 25mm orifice within each side yard catchbasin will restrict discharge to the roadside ditch with a peak outflow of 1.0 l/s. As stated, the cumulative storage volumes achieved by lot level storage is sufficient to control the 2 year storm to the predevelopment level. A detail of the catchbasins and orifice can be seen in Figure 4. The Inflow-Outflow Hydrograph can be seen in Appendix D.

The second level of control is by surface storage within the roadside ditches. Culverts have been sized to restrict flows during the 100 year storm. The culverts utilized as flow restrictions are the 450 dia. CSP crossing Moonlight Way, The 300 dia. CSP for Part 1, Starlight Lane, and the 600 dia. CSP for Part 7, Starlight Lane. The combination of lot storage and road side ditch storage restrict flows to predevelopment levels for the 100 year storm. The Inflow-Outflow Hydrograph can be seen in Appendix E.

Discharge from the site is at the northeast corner of the site through an open channel, which is to be lined with rip-rap. Should development occur to the north, the road side ditches would need to be extended to accept flows from the subdivision and be sized accordingly.



9 CATCHMENT AREA NUMBER

FIGURE No. 2
MIDUSS MODELING SCHEMATIC
PREDEVELOPMENT

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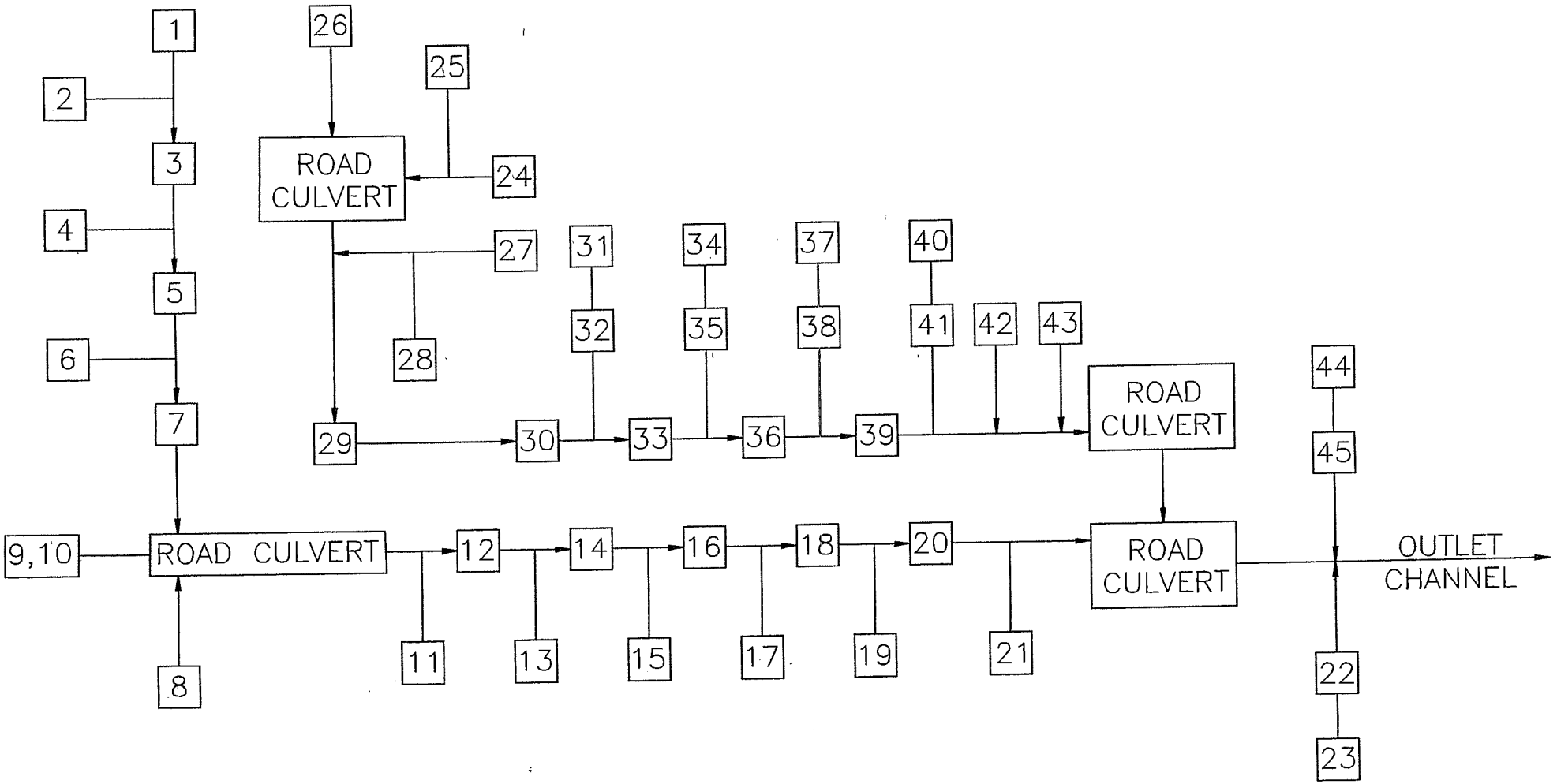

9 CATCHMENT AREA NUMBER

FIGURE No. 3
MIDUSS MODELING SCHEMATIC
POST DEVELOPMENT

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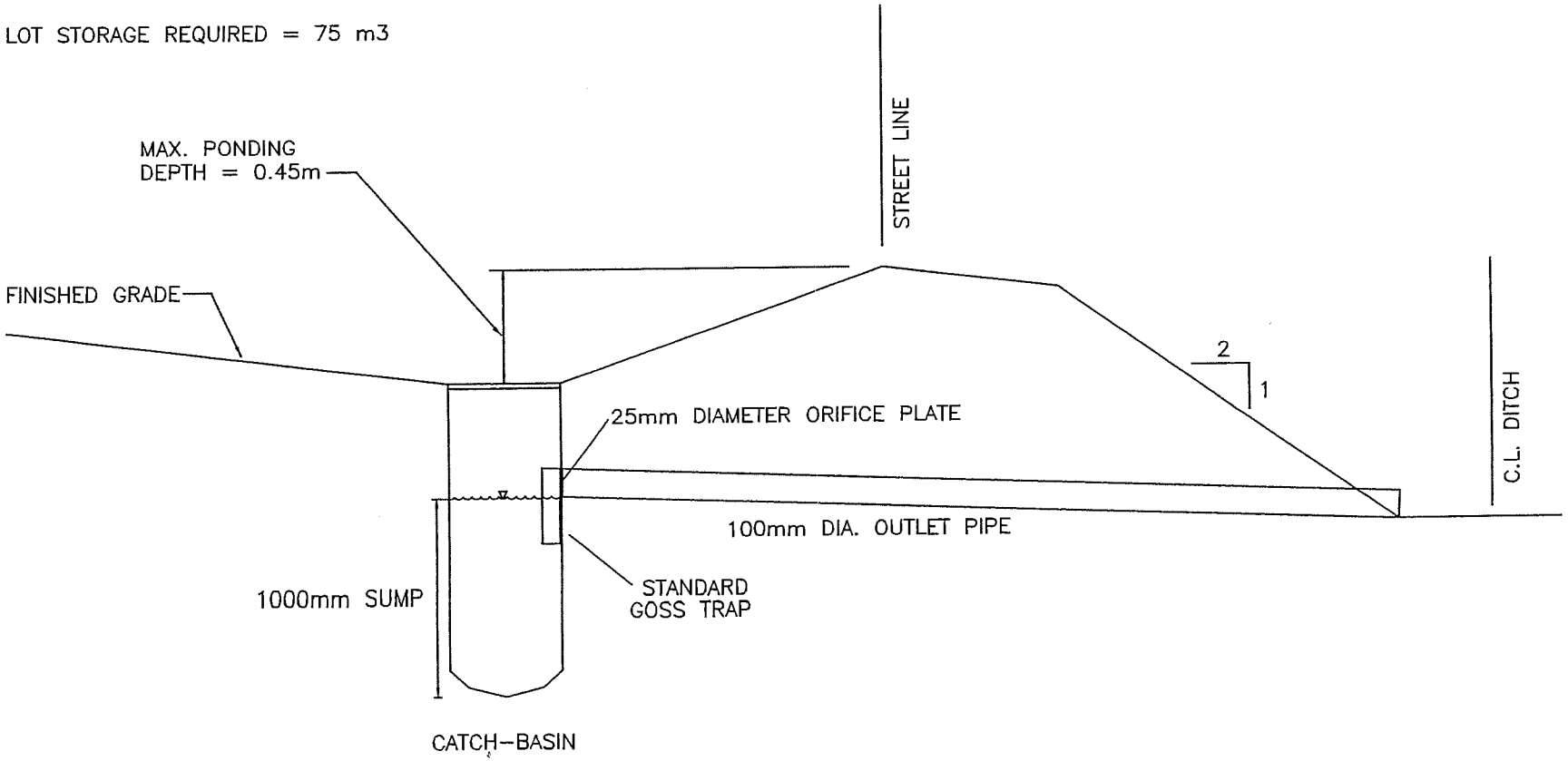

FIGURE No. 4
LOT LEVEL CONTROL

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ENGINEERING LTD.
LONDON 685-5300

3.0 EROSION AND SEDIMENTATION CONTROL

The following measures are to be incorporated during and after construction and have been added to the appropriate drawings for construction:

1. Protect all exposed surfaces and control runoff during construction.
2. All erosion control measures are to be in place before starting construction and remain in place until restoration is complete.
3. Maintain all erosion control measures during construction.
4. All collected sediment to be disposed of at an approved site.
5. Minimize area disturbed during construction.
6. All dewatering is to be disposed of in an approved sediment basin.
7. Protect all catchbasins and manholes from sediment intrusion with geotextile (Terrafix silt sack of approved equivalent).
8. Maintain depressed area around catchbasins during construction to prevent sedimentation intrusion.
9. Keep all sumps clean during construction
10. Prevent wind-blown dust.
11. All of the above notes and any sediment and erosion control measures are at a minimum to be in accordance with the Ministry of Natural Resources guidelines on erosion and sediment control for urban construction sites.

4.0 CONCLUSION

The Stormwater Management measures to be incorporated in the subdivision will restrict post development flows to predevelopment levels by way of lot level controls for the 2 year storm and a combination of lot level controls and roadside ditch controls for the 100 year storm.

Yours truly,
Archibald, Gray and McKay Engineering Ltd.

Steve Brown, P.Eng.
Project Engineer

APPENDIX A

HYDROLOGIC MODELING PARAMETERS

SCS Soil Types

The following four classifications of soil are used.

Type A	Deep, very well drained sand or gravel
Type B	Moderately well drained soil with medium texture
Type C	Fine soil with an infiltration impeding layer
Type D	Clay; soil over rock; soil with a permanent high water table

Click here to return to Pervious SCS Curve Number

Click here to return to the Catchment Command.

Pervious SCS Curve number

CN depends on Soil Type, Antecedent Moisture and Land Use.

Click Soil Types for classification

Click Dry and Wet CN values for variation from normal conditions.

Land Use	Soil type	A	B	C	D
Cultivated land with no conservation treatment		72	81	88	91
Cultivated land with conservation treatment		62	71	78	81
Pasture in poor condition		68	79	86	89
Pasture in good condition		39	61	74	81
Woodland - poor cover		45	66	77	83
Woodland - good cover		25	55	70	77
Park land - >75% grass		39	61	74	80
Park land - 50-75% grass		49	69	79	84

In some texts you may see values of CN quoted as a function of the percentage of impervious area. These are usually calculated as a weighted average assuming CNimpervious = 98 and CNpervious equal to the value for 'Pasture in good condition' for the various soil types A, B, C or D. This is often done using an equation of the form:

$$[3.10] \qquad CN_{equiv} = \left(\%I\ CN_{imperv} + (100 - \%I)CN_{perv}\right)/100$$

where %I is the percentage of impervious area.

Values of CN estimated in this way are intended to be applied to the **total** catchment assuming other parameters to be the same for both pervious and impervious areas. Many programs (including MIDUSS 98) compute the runoff from the pervious and impervious fractions separately and then add the two hydrographs. In such cases, it is most important that you **do not use** a composite value of CN since this would 'double count' the impervious fraction and greatly exaggerate the runoff prediction.

Impervious

Set Parameters for the Trapezoidal Channel

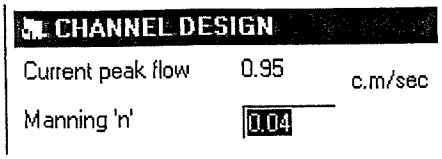


Figure 4-12 – Setting the Manning 'n' value for the channel

A value for Manning "n" must be entered in order for the table of feasible designs to be shown. The initial default value as shown here is 0.04. The table below shows some suggested values for different types and conditions of channel. Notice that the roughness for channel flow is very different from that for overland flow.

Description	"n"
Concrete lined, screeded and smoothed	0.014
Gunite concrete, not smoothed with sandy deposits	0.018
Irrigation canal in hard-packed smooth sand	0.020
Canal excavated in silty clay	0.024
Channel with cobble stone bottom	0.028
Natural channel with fairly regular cross-section	0.035
Natural channel, irregular section, grass slopes	0.040
Dredged channel, irregular side slopes, grass and weeds	0.050
Irregular channel with dense growth, little foliage	0.080
Irregular channel with dense growth, with much foliage and vegetation	0.110

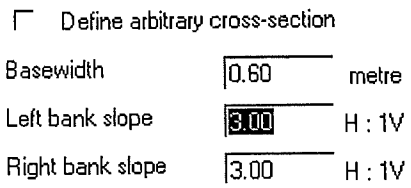


Figure 4_13 - Defining a trapezoidal cross-section.

The base width and side slopes are self-explanatory. By selecting appropriate values, trapezoidal, rectangular or triangular sections can be defined. You will find that a trapezoidal section can often be a good approximation for a natural channel. Negative (i.e. overhanging) sideslopes are not allowed with the trapezoidal cross-section.

With flow and roughness defined you can now Review the Feasible Designs

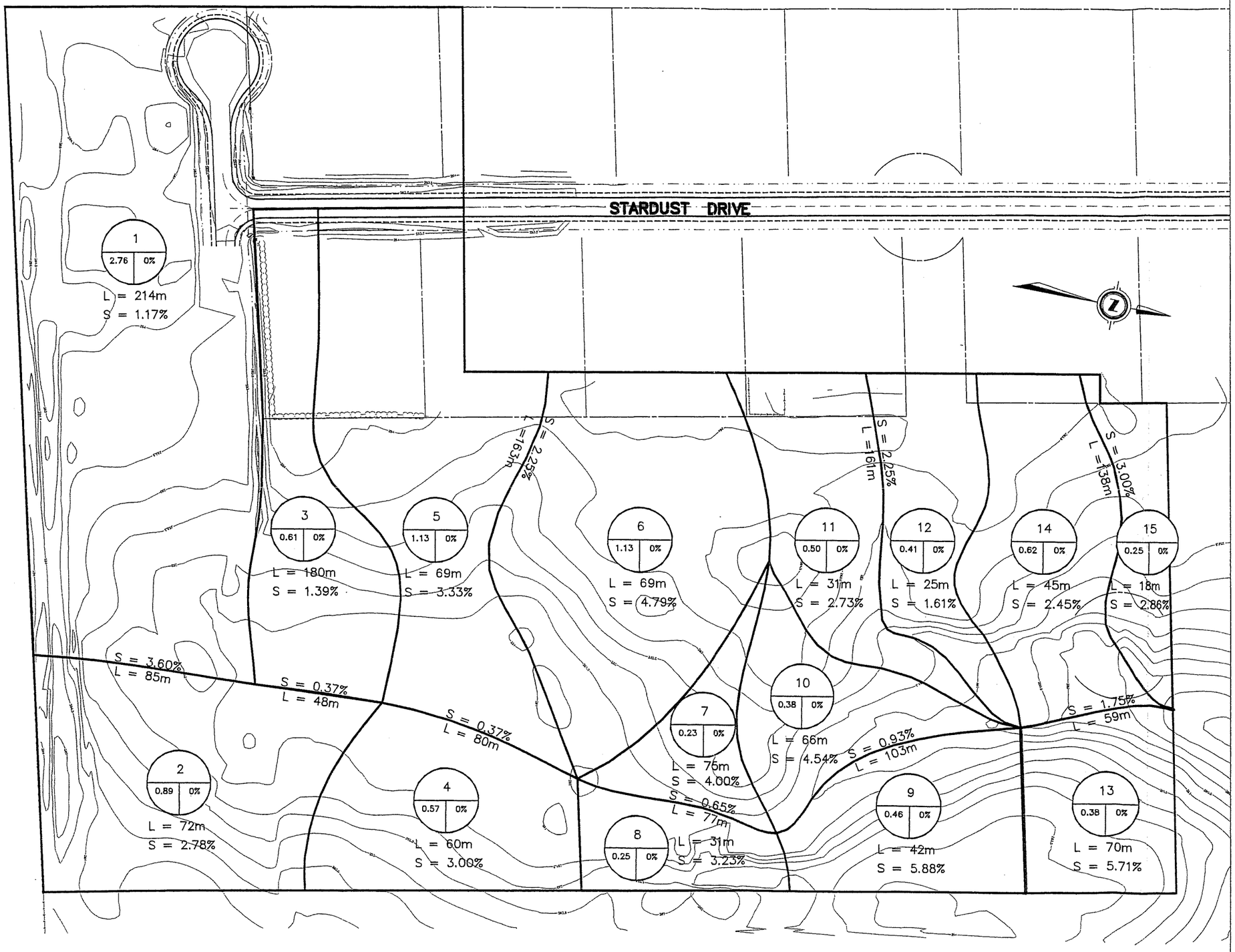
Click to return to Channel Design.

APPENDIX B

CATCHMENT AREA PLAN

MIDUSS OUTPUT

2 YEAR STORM - PREDEVELOPMENT



00 — CATCHMENT
00 — % IMPERVIOUS
00.00 — AREA (ha)

PREDEVELOPMENT CATCHMENT AREAS

SCALE 1:1500

DATE : JUNE 1, 2004

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LONDON 685-5300

Plot date: Jun 01, 2004 G:\CLIENT\1133\1\DWG\1133-1135-1BASE.dwg

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"                Output filename:                                   2yrPRE.Out"
"                Licensee name:                                    Steve Brown"
"                Company                                      AGM Engineering Ltd."
"                Date & Time last used:                    01/06/04 at 10:17:03 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1200.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      724.690   Coefficient A"
"        5.500   Constant B"
"        0.800   Exponent C"
"        0.350   Fraction R"
"      180.000   Duration"
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"            6   002hyd   Hydrograph extension used in this file"
================================================================
                          CATCHMENT 1
================================================================
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"            1   Equal length"
"            1   SCS method"
"            1   ID number"
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"      214.000   Flow length"
"        1.170   Overland Slope"
"        2.760   Pervious Area"
"      214.000   Pervious length"
"        1.170   Pervious slope"
"        0.000   Impervious Area"
"      214.000   Impervious length"
"        1.170   Impervious slope"
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"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.024     0.000     0.000     0.000 c.m/sec"
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"             Time of concentration  91.149     8.718      91.149     minutes"
"             Time to Centroid       203.771    0.000      203.771    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        919.41     0.00       919.41     c.m"
"             Rainfall losses        24.706     33.312     24.706     mm"
"             Runoff depth           8.606      0.000      8.606      mm"
"             Runoff volume          237.53     0.00       237.53     c.m"
"             Maximum flow           0.024      0.000      0.024      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.024     0.024     0.000     0.000"
================================================================
                          CATCHMENT 2
================================================================
" 33          CATCHMENT 2"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            2   ID number"
"        0.000   % Impervious"
"        0.890   Total Area"
"       72.000   Flow length"
"        2.780   Overland Slope"
"        0.890   Pervious Area"
"       72.000   Pervious length"
"        2.780   Pervious slope"
"        0.000   Impervious Area"
"       72.000   Impervious length"
"        2.780   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.016     0.024     0.000     0.000 c.m/sec"
"             Catchment 2            Pervious   Impervious Total Area "
"             Surface Area           0.890      0.000      0.890      hectare"
"             Time of concentration  36.572     3.498      36.572     minutes"
"             Time to Centroid       138.712    87.608     138.712    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        296.48     0.00       296.48     c.m"
"             Rainfall losses        24.707     5.630      24.707     mm"
```

```
"            5   Next link "
"                    0.006      0.040      0.040      0.000"
================================================================
                          CATCHMENT 4
================================================================
" 33          CATCHMENT 4"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"             4   ID number"
"         0.000   % Impervious"
"         0.570   Total Area"
"        60.000   Flow length"
"         3.000   Overland Slope"
"         0.570   Pervious Area"
"        60.000   Pervious length"
"         3.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         3.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
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"         0.015   Impervious Manning 'n'"
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"         0.100   Impervious Ia/S coefficient"
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"              Catchment 4              Pervious   Impervious Total Area "
"              Surface Area             0.570      0.000      0.570      hectare"
"              Time of concentration    32.042     3.065      32.042     minutes"
"              Time to Centroid         133.326    86.868     133.326    minutes"
"              Rainfall depth           33.312     33.312     33.312     mm"
"              Rainfall volume          189.88     0.00       189.88     c.m"
"              Rainfall losses          24.710     5.554      24.710     mm"
"              Runoff depth             8.602      27.758     8.602      mm"
"              Runoff volume            49.03      0.00       49.03      c.m"
"              Maximum flow             0.011      0.000      0.011      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.011      0.045      0.040      0.000"
" 52          CHANNEL DESIGN"
"         0.045   Current peak flow    c.m/sec"
"         0.040   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"        72.000   Left bank slope"
"        33.000   Right bank slope"
"         1.000   Channel depth    metre"
"         0.370   Gradient   %"
"              Depth of flow                 0.072    metre"
"              Velocity                      0.166    m/sec"
"              Channel capacity              50.287   c.m/sec"
"              Critical depth                0.043    metre"
" 53          ROUTE 80"
"         80.00   Reach length( metre)"
"         0.409   X-factor <= 0.5"
"       181.182   K-lag    ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag    ( seconds)"
"         0.500   Beta weighting factor"
"       300.000   Routing time step    ( seconds)"
"             2   No. of sub-reaches"
"              Peak outflow                  0.045    c.m/sec"
"                    0.011      0.045      0.045      0.000 c.m/sec"
" 40          HYDROGRAPH    Combine    1"
"             6   Combine "
"             1   Node #"
"                 "
"              Maximum flow                  0.045    c.m/sec"
"              Hydrograph volume             415.633    c.m"
"                    0.011      0.045      0.045      0.045"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.011      0.000      0.045      0.045"
================================================================
                          CATCHMENT 5
================================================================
" 33          CATCHMENT 5"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"             5   ID number"
"         0.000   % Impervious"
"         1.130   Total Area"
"        69.000   Flow length"
"         3.330   Overland Slope"
"         1.130   Pervious Area"
"        69.000   Pervious length"
"         3.330   Pervious slope"
"         0.000   Impervious Area"
"        69.000   Impervious length"
"         3.330   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
```

```
================================================================
" 33          CATCHMENT 7"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"             7   ID number"
"         0.000   % Impervious"
"         0.230   Total Area"
"        75.000   Flow length"
"         4.000   Overland Slope"
"         0.230   Pervious Area"
"        75.000   Pervious length"
"         4.000   Pervious slope"
"         0.000   Impervious Area"
"        75.000   Impervious length"
"         4.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.850   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.004     0.081     0.044     0.000 c.m/sec"
"               Catchment 7           Pervious   Impervious Total Area "
"               Surface Area          0.230      0.000      0.230      hectare"
"               Time of concentration 33.603     3.214      33.603     minutes"
"               Time to Centroid      135.176    87.121     135.176    minutes"
"               Rainfall depth        33.312     33.312     33.312     mm"
"               Rainfall volume       76.62      0.00       76.62      c.m"
"               Rainfall losses       24.709     5.556      24.709     mm"
"               Runoff depth          8.603      27.756     8.603      mm"
"               Runoff volume         19.79      0.00       19.79      c.m"
"               Maximum flow          0.004      0.000      0.004      c.m/sec"
" 40            HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.004     0.085     0.044     0.000"
================================================================
                            CATCHMENT 8
================================================================
" 33          CATCHMENT 8"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"             8   ID number"
"         0.000   % Impervious"
"         0.250   Total Area"
"        31.000   Flow length"
"         3.230   Overland Slope"
"         0.250   Pervious Area"
"        31.000   Pervious length"
"         3.230   Pervious slope"
"         0.000   Impervious Area"
"        31.000   Impervious length"
"         3.230   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.850   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.006     0.085     0.044     0.000 c.m/sec"
"               Catchment 8           Pervious   Impervious Total Area "
"               Surface Area          0.250      0.000      0.250      hectare"
"               Time of concentration 21.087     2.017      21.087     minutes"
"               Time to Centroid      120.257    85.202     120.257    minutes"
"               Rainfall depth        33.312     33.312     33.312     mm"
"               Rainfall volume       83.28      0.00       83.28      c.m"
"               Rainfall losses       24.711     5.386      24.711     mm"
"               Runoff depth          8.601      27.926     8.601      mm"
"               Runoff volume         21.50      0.00       21.50      c.m"
"               Maximum flow          0.006      0.000      0.006      c.m/sec"
" 40            HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.006     0.088     0.044     0.000"
" 52            CHANNEL DESIGN"
"         0.088   Current peak flow    c.m/sec"
"         0.040   Manning 'n'"
"           0.    Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"        25.000   Left bank slope"
"        31.000   Right bank slope"
"         1.000   Channel depth    metre"
"         0.650   Gradient   %"
"               Depth of flow                 0.105    metre"
"               Velocity                      0.283    m/sec"
"               Channel capacity             35.537    c.m/sec"
"               Critical depth                0.073    metre"
" 53            ROUTE 77"
"         77.00   Reach length( metre)"
"         0.460   X-factor <= 0.5"
"       203.855   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
```

```
"              Velocity                          0.366    m/sec"
"              Channel capacity                 29.590    c.m/sec"
"              Critical depth                    0.088    metre"
" 53           ROUTE 103"
"        103.00   Reach length( metre)"
"          0.477  X-factor <= 0.5"
"        211.042  K-lag    ( seconds)"
"          0.000  Default(0) or user spec.(1) values used"
"          0.500  X-factor <= 0.5"
"         30.000  K-lag    ( seconds)"
"          0.500  Beta weighting factor"
"        150.000  Routing time step   ( seconds)"
"              1  No. of sub-reaches"
"              Peak outflow                      0.100    c.m/sec"
"                    0.008     0.100     0.100     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    2"
"              6  Combine "
"              2  Node #"
"                 "
"              Maximum flow                      0.100    c.m/sec"
"              Hydrograph volume               723.613    c.m"
"                    0.008     0.100     0.100     0.100"
" 40           HYDROGRAPH Start - New Tributary"
"              2  Start - New Tributary"
"                    0.008     0.000     0.100     0.100"
================================================================
                          CATCHMENT 11
================================================================
" 33           CATCHMENT 11"
"              1  Triangular SCS"
"              1  Equal length"
"              1  SCS method"
"             11  ID number"
"          0.000  % Impervious"
"          0.500  Total Area"
"         31.000  Flow length"
"          2.730  Overland Slope"
"          0.500  Pervious Area"
"         31.000  Pervious length"
"          2.730  Pervious slope"
"          0.000  Impervious Area"
"         31.000  Impervious length"
"          2.730  Impervious slope"
"          0.250  Pervious Manning 'n'"
"         81.000  Pervious SCS Curve No."
"          0.258  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          5.958  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"         98.000  Impervious SCS Curve No."
"          0.850  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"                    0.012     0.000     0.100     0.100 c.m/sec"
"              Catchment 11          Pervious   Impervious Total Area "
"              Surface Area          0.500      0.000      0.500      hectare"
"              Time of concentration 22.178     2.121      22.178     minutes"
"              Time to Centroid      121.571    85.364     121.571    minutes"
"              Rainfall depth        33.312     33.312     33.312     mm"
"              Rainfall volume       166.56     0.00       166.56     c.m"
"              Rainfall losses       24.721     5.370      24.721     mm"
"              Runoff depth          8.591      27.942     8.591      mm"
"              Runoff volume         42.95      0.00       42.95      c.m"
"              Maximum flow          0.012      0.000      0.012      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"              4  Add Runoff "
"                    0.012     0.012     0.100     0.100"
================================================================
                          CATCHMENT 12
================================================================
" 33           CATCHMENT 12"
"              1  Triangular SCS"
"              1  Equal length"
"              1  SCS method"
"             12  ID number"
"          0.000  % Impervious"
"          0.410  Total Area"
"         25.000  Flow length"
"          1.610  Overland Slope"
"          0.410  Pervious Area"
"         25.000  Pervious length"
"          1.610  Pervious slope"
"          0.000  Impervious Area"
"         25.000  Impervious length"
"          1.610  Impervious slope"
"          0.250  Pervious Manning 'n'"
"         81.000  Pervious SCS Curve No."
"          0.258  Pervious Runoff coefficient"
"          0.100  Pervious Ia/S coefficient"
"          5.958  Pervious Initial abstraction"
"          0.015  Impervious Manning 'n'"
"         98.000  Impervious SCS Curve No."
"          0.850  Impervious Runoff coefficient"
"          0.100  Impervious Ia/S coefficient"
"          0.518  Impervious Initial abstraction"
"                    0.010     0.012     0.100     0.100 c.m/sec"
"              Catchment 12          Pervious   Impervious Total Area "
"              Surface Area          0.410      0.000      0.410      hectare"
"              Time of concentration 22.839     2.184      22.839     minutes"
"              Time to Centroid      122.356    85.457     122.356    minutes"
"              Rainfall depth        33.312     33.312     33.312     mm"
"              Rainfall volume       136.58     0.00       136.58     c.m"
```

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"        59.00   Reach length( metre)"
"        0.482   X-factor <= 0.5"
"       99.700   K-lag    ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag    ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step    ( seconds)"
"            1   No. of sub-reaches"
"                Peak outflow                0.123    c.m/sec"
"                     0.008     0.124     0.123     0.000 c.m/sec"
" 40             HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                "
"                Maximum flow                0.123    c.m/sec"
"                Hydrograph volume         834.498    c.m"
"                     0.008     0.124     0.123     0.123"
" 40             HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                     0.008     0.000     0.123     0.123"
=================================================================
                          CATCHMENT 14
=================================================================
" 33             CATCHMENT 14"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           14   ID number"
"        0.000   % Impervious"
"        0.620   Total Area"
"       45.000   Flow length"
"        2.450   Overland Slope"
"        0.620   Pervious Area"
"       45.000   Pervious length"
"        2.450   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.450   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.013     0.000     0.123     0.123 c.m/sec"
"                Catchment 14            Pervious   Impervious Total Area "
"                Surface Area            0.620      0.000      0.620      hectare"
"                Time of concentration   28.651     2.740      28.651     minutes"
"                Time to Centroid        129.280    86.343     129.280    minutes"
"                Rainfall depth          33.312     33.312     33.312     mm"
"                Rainfall volume         206.53     0.00       206.53     c.m"
"                Rainfall losses         24.715     5.461      24.715     mm"
"                Runoff depth            8.597      27.851     8.597      mm"
"                Runoff volume           53.30      0.00       53.30      c.m"
"                Maximum flow            0.013      0.000      0.013      c.m/sec"
" 40             HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.013     0.013     0.123     0.123"
=================================================================
                          CATCHMENT 15
=================================================================
" 33             CATCHMENT 15"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           15   ID number"
"        0.000   % Impervious"
"        0.250   Total Area"
"       18.000   Flow length"
"        2.860   Overland Slope"
"        0.250   Pervious Area"
"       18.000   Pervious length"
"        2.860   Pervious slope"
"        0.000   Impervious Area"
"       18.000   Impervious length"
"        2.860   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.008     0.013     0.123     0.123 c.m/sec"
"                Catchment 15            Pervious   Impervious Total Area "
"                Surface Area            0.250      0.000      0.250      hectare"
"                Time of concentration   15.784     1.510      15.784     minutes"
"                Time to Centroid        113.997    84.410     113.997    minutes"
"                Rainfall depth          33.312     33.312     33.312     mm"
"                Rainfall volume         83.28      0.00       83.28      c.m"
"                Rainfall losses         24.739     5.436      24.739     mm"
"                Runoff depth            8.573      27.876     8.573      mm"
"                Runoff volume           21.43      0.00       21.43      c.m"
"                Maximum flow            0.008      0.000      0.008      c.m/sec"
```
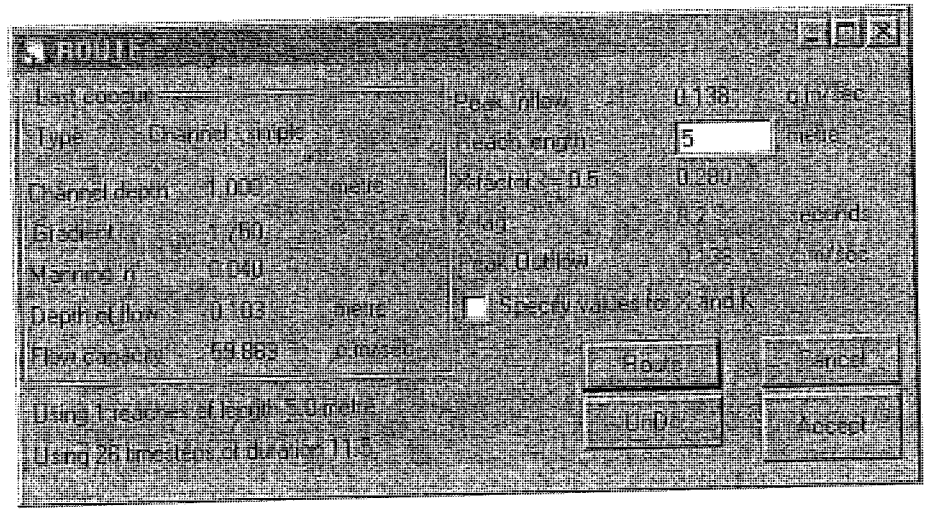
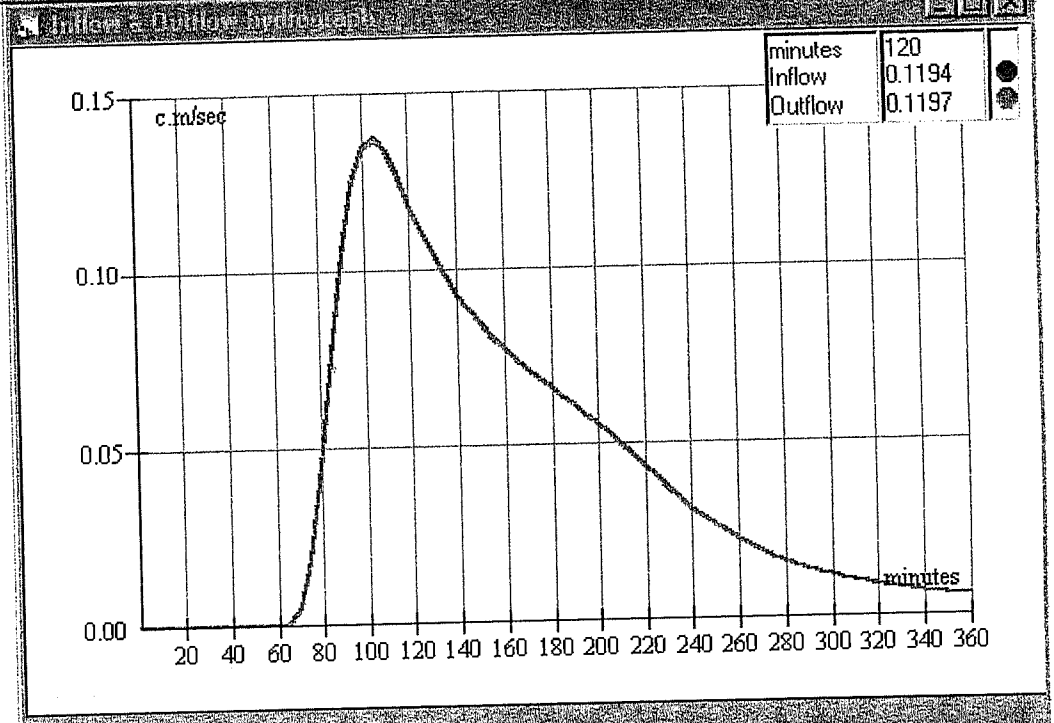

Hiduss98 Steve Brown - AGM Engineering Ltd. Tuesday, June 01,2004,11:14 AM

File Options Hydrology Hydrograph Design Show Automatic Tools Window Help





of duration 360 minutes

Outflow Hydrograph

Total volume 909.23 c.m Maximum flow 0.138 c.m/sec 0.0 minutes

	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5.0	0.000	0.000	0.001	0.005	0.019	0.044	0.076	0.104	0.124	0.135
05.0	0.138	0.135	0.127	0.119	0.112	0.104	0.098	0.092	0.088	0.084
55.0	0.080	0.077	0.074	0.071	0.069	0.066	0.063	0.061	0.058	0.056
05.0	0.053	0.050	0.047	0.044	0.041	0.038	0.035	0.032	0.029	0.027
55.0	0.025	0.023	0.021	0.019	0.018	0.016	0.015	0.014	0.013	0.012
05.0	0.011	0.010	0.010	0.009	0.009	0.008	0.008	0.007	0.007	0.006
55.0	0.006	0.006	0.005	0.005	0.005	0.005	0.004	0.004	0.004	0.004
05.0	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.002	0.002
55.0	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
05.0	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
55.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
05.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PEAK FLOWS (cfs)

No.	Command	Runoff	Inflow	Outflow	Junction
61	Channel Design	0.008	0.019	0.123	0.123
62	Channel Route 138	0.008	0.019	0.019	0.123
63	Combine 3	0.008	0.019	0.019	0.138
64	Confluence 3	0.008	0.138	0.019	0.000
65	Channel Design	0.008	0.138	0.019	0.000

Input 20:1 Out Manual Output 20:1 PRE Out

Has options to define input and output files and control screen printing

Graphics Server

APPENDIX C

MIDUSS OUTPUT

100 YEAR STORM – PREDEVELOPMENT

```
"                MIDUSS 98 Output---------------------------------------------->"
"                MIDUSS 98 version number                                  1.00"
"                MIDUSS 98 created                                 October 10, 2001"
"                Units used:                                             ie METRIC"
"           10   Project filename:                          G:\CLIENT\1133\1\MIDUSS\"
"                Output filename:                                   100yrPRE1.Out"
"                Licensee name:                                        Steve Brown"
"                Company                                    AGM Engineering Ltd."
"                Date & Time last used:                    01/06/04 at 11:42:11 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1200.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1499.530   Coefficient A"
"        3.297   Constant B"
"        0.794   Exponent C"
"        0.350   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity          264.015    mm/hr"
"             Total depth                 71.801    mm"
"            6   100hyd   Hydrograph extension used in this file"
=================================================================
                          CATCHMENT 1
=================================================================
" 33          CATCHMENT 1"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            1   ID number"
"        0.000   % Impervious"
"        2.760   Total Area"
"      214.000   Flow length"
"        1.170   Overland Slope"
"        2.760   Pervious Area"
"      214.000   Pervious length"
"        1.170   Pervious slope"
"        0.000   Impervious Area"
"      214.000   Impervious length"
"        1.170   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.179     0.000     0.000     0.000 c.m/sec"
"              Catchment 1            Pervious   Impervious Total Area "
"              Surface Area           2.760      0.000      2.760      hectare"
"              Time of concentration  43.811     5.823      43.811     minutes"
"              Time to Centroid       149.555    88.852     149.555    minutes"
"              Rainfall depth         71.801     71.801     71.801     mm"
"              Rainfall volume        1981.71    0.00       1981.71    c.m"
"              Rainfall losses        37.247     5.586      37.247     mm"
"              Runoff depth           34.554     66.215     34.554     mm"
"              Runoff volume          953.70     0.00       953.70     c.m"
"              Maximum flow           0.179      0.000      0.179      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.179     0.179     0.000     0.000"
=================================================================
                          CATCHMENT 2
=================================================================
" 33          CATCHMENT 2"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            2   ID number"
"        0.000   % Impervious"
"        0.890   Total Area"
"       72.000   Flow length"
"        2.780   Overland Slope"
"        0.890   Pervious Area"
"       72.000   Pervious length"
"        2.780   Pervious slope"
"        0.000   Impervious Area"
"       72.000   Impervious length"
"        2.780   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.111     0.179     0.000     0.000 c.m/sec"
"              Catchment 2            Pervious   Impervious Total Area "
"              Surface Area           0.890      0.000      0.890      hectare"
"              Time of concentration  17.578     2.337      17.578     minutes"
"              Time to Centroid       113.102    83.260     113.102    minutes"
"              Rainfall depth         71.801     71.801     71.801     mm"
"              Rainfall volume        639.03     0.00       639.03     c.m"
"              Rainfall losses        37.245     6.103      37.245     mm"
```

```
"            5   Next link "
"                    0.045     0.287     0.287     0.000"
================================================================
                          CATCHMENT 4
================================================================
" 33          CATCHMENT 4"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"             4   ID number"
"         0.000   % Impervious"
"         0.570   Total Area"
"        60.000   Flow length"
"         3.000   Overland Slope"
"         0.570   Pervious Area"
"        60.000   Pervious length"
"         3.000   Pervious slope"
"         0.000   Impervious Area"
"        60.000   Impervious length"
"         3.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.925   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.077     0.287     0.287     0.000 c.m/sec"
"              Catchment 4            Pervious   Impervious Total Area "
"              Surface Area           0.570      0.000      0.570      hectare"
"              Time of concentration  15.401     2.047      15.401     minutes"
"              Time to Centroid       110.103    82.820     110.103    minutes"
"              Rainfall depth         71.801     71.801     71.801     mm"
"              Rainfall volume        409.27     0.00       409.27     c.m"
"              Rainfall losses        37.284     6.111      37.284     mm"
"              Runoff depth           34.517     65.690     34.517     mm"
"              Runoff volume          196.75     0.00       196.75     c.m"
"              Maximum flow           0.077      0.000      0.077      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.077     0.328     0.287     0.000"
" 52          CHANNEL DESIGN"
"         0.328   Current peak flow    c.m/sec"
"         0.040   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         0.000   Basewidth    metre"
"        72.000   Left bank slope"
"        33.000   Right bank slope"
"         1.000   Channel depth    metre"
"         0.370   Gradient   %"
"              Depth of flow                  0.151    metre"
"              Velocity                       0.272    m/sec"
"              Channel capacity              50.287    c.m/sec"
"              Critical depth                 0.096    metre"
" 53          ROUTE 80"
"         80.00   Reach length( metre)"
"         0.404   X-factor <= 0.5"
"       220.436   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.500   Beta weighting factor"
"       150.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                   0.325    c.m/sec"
"                    0.077     0.328     0.325     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"             6   Combine "
"             1   Node #"
"                 "
"              Maximum flow                   0.325    c.m/sec"
"              Hydrograph volume           1668.733    c.m"
"                    0.077     0.328     0.325     0.325"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.077     0.000     0.325     0.325"
================================================================
                          CATCHMENT 5
================================================================
" 33          CATCHMENT 5"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"             5   ID number"
"         0.000   % Impervious"
"         1.130   Total Area"
"        69.000   Flow length"
"         3.330   Overland Slope"
"         1.130   Pervious Area"
"        69.000   Pervious length"
"         3.330   Pervious slope"
"         0.000   Impervious Area"
"        69.000   Impervious length"
"         3.330   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
```

```
================================================================
" 33          CATCHMENT 7"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            7   ID number"
"        0.000   % Impervious"
"        0.230   Total Area"
"       75.000   Flow length"
"        4.000   Overland Slope"
"        0.230   Pervious Area"
"       75.000   Pervious length"
"        4.000   Pervious slope"
"        0.000   Impervious Area"
"       75.000   Impervious length"
"        4.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.030     0.567     0.301     0.000 c.m/sec"
"             Catchment 7           Pervious   Impervious Total Area "
"             Surface Area          0.230      0.000      0.230      hectare"
"             Time of concentration 16.151     2.147      16.151     minutes"
"             Time to Centroid      111.188    82.948     111.188    minutes"
"             Rainfall depth        71.801     71.801     71.801     mm"
"             Rainfall volume       165.14     0.00       165.14     c.m"
"             Rainfall losses       37.381     6.073      37.381     mm"
"             Runoff depth          34.420     65.728     34.420     mm"
"             Runoff volume         79.17      0.00       79.17      c.m"
"             Maximum flow          0.030      0.000      0.030      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.030     0.594     0.301     0.000"
================================================================
                          CATCHMENT 8
================================================================
" 33          CATCHMENT 8"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            8   ID number"
"        0.000   % Impervious"
"        0.250   Total Area"
"       31.000   Flow length"
"        3.230   Overland Slope"
"        0.250   Pervious Area"
"       31.000   Pervious length"
"        3.230   Pervious slope"
"        0.000   Impervious Area"
"       31.000   Impervious length"
"        3.230   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.043     0.594     0.301     0.000 c.m/sec"
"             Catchment 8           Pervious   Impervious Total Area "
"             Surface Area          0.250      0.000      0.250      hectare"
"             Time of concentration 10.135     1.347      10.135     minutes"
"             Time to Centroid      102.810    81.753     102.810    minutes"
"             Rainfall depth        71.801     71.801     71.801     mm"
"             Rainfall volume       179.50     0.00       179.50     c.m"
"             Rainfall losses       37.420     6.661      37.420     mm"
"             Runoff depth          34.381     65.140     34.381     mm"
"             Runoff volume         85.95      0.00       85.95      c.m"
"             Maximum flow          0.043      0.000      0.043      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.043     0.617     0.301     0.000"
" 52          CHANNEL DESIGN"
"          0.617   Current peak flow    c.m/sec"
"          0.040   Manning 'n'"
"             0.   Cross-section type: 0=trapezoidal; 1=general"
"          0.000   Basewidth    metre"
"         25.000   Left bank slope"
"         31.000   Right bank slope"
"          1.000   Channel depth    metre"
"          0.650   Gradient   %"
"               Depth of flow                  0.219    metre"
"               Velocity                       0.461    m/sec"
"               Channel capacity              35.537    c.m/sec"
"               Critical depth                 0.158    metre"
" 53          ROUTE 77"
"          77.00   Reach length( metre)"
"          0.418   X-factor <= 0.5"
"        125.342   K-lag   ( seconds)"
"          0.000   Default(0) or user spec.(1) values used"
"          0.500   X-factor <= 0.5"
"         30.000   K-lag   ( seconds)"
```

```
"             Velocity                          0.592    m/sec"
"             Channel capacity                 29.590    c.m/sec"
"             Critical depth                    0.191    metre"
" 53          ROUTE 103"
"       103.00   Reach length( metre)"
"        0.452   X-factor <= 0.5"
"      130.405   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                      0.675    c.m/sec"
"                   0.053     0.687     0.675     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"             Maximum flow                      0.675    c.m/sec"
"             Hydrograph volume              2902.604    c.m"
"                   0.053     0.687     0.675     0.675"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.053     0.000     0.675     0.675"
================================================================
                          CATCHMENT 11
================================================================
" 33          CATCHMENT 11"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           11   ID number"
"        0.000   % Impervious"
"        0.500   Total Area"
"       31.000   Flow length"
"        2.730   Overland Slope"
"        0.500   Pervious Area"
"       31.000   Pervious length"
"        2.730   Pervious slope"
"        0.000   Impervious Area"
"       31.000   Impervious length"
"        2.730   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.083     0.000     0.675     0.675 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.500      0.000      0.500      hectare"
"             Time of concentration  10.660     1.417      10.660     minutes"
"             Time to Centroid       103.505    81.818     103.505    minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        359.01     0.00       359.01     c.m"
"             Rainfall losses        37.365     6.554      37.365     mm"
"             Runoff depth           34.436     65.247     34.436     mm"
"             Runoff volume          172.18     0.00       172.18     c.m"
"             Maximum flow           0.083      0.000      0.083      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.083     0.083     0.675     0.675"
================================================================
                          CATCHMENT 12
================================================================
" 33          CATCHMENT 12"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           12   ID number"
"        0.000   % Impervious"
"        0.410   Total Area"
"       25.000   Flow length"
"        1.610   Overland Slope"
"        0.410   Pervious Area"
"       25.000   Pervious length"
"        1.610   Pervious slope"
"        0.000   Impervious Area"
"       25.000   Impervious length"
"        1.610   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.067     0.083     0.675     0.675 c.m/sec"
"             Catchment 12           Pervious   Impervious Total Area "
"             Surface Area           0.410      0.000      0.410      hectare"
"             Time of concentration  10.977     1.459      10.977     minutes"
"             Time to Centroid       103.942    81.847     103.942    minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        294.38     0.00       294.38     c.m"
```

```
"        59.00   Reach length( metre)"
"        0.464   X-factor <= 0.5"
"       61.932   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                    0.812    c.m/sec"
"                   0.056     0.830     0.812     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                "
"             Maximum flow                    0.812    c.m/sec"
"             Hydrograph volume            3347.078    c.m"
"                   0.056     0.830     0.812     0.812"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.056     0.000     0.812     0.812"
================================================================
                          CATCHMENT 14
================================================================
" 33          CATCHMENT 14"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           14   ID number"
"        0.000   % Impervious"
"        0.620   Total Area"
"       45.000   Flow length"
"        2.450   Overland Slope"
"        0.620   Pervious Area"
"       45.000   Pervious length"
"        2.450   Pervious slope"
"        0.000   Impervious Area"
"       45.000   Impervious length"
"        2.450   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.091     0.000     0.812     0.812 c.m/sec"
"             Catchment 14            Pervious   Impervious Total Area "
"             Surface Area            0.620      0.000      0.620      hectare"
"             Time of concentration   13.771     1.830      13.771     minutes"
"             Time to Centroid        107.853    82.493     107.853    minutes"
"             Rainfall depth          71.801     71.801     71.801     mm"
"             Rainfall volume         445.17     0.00       445.17     c.m"
"             Rainfall losses         37.329     6.225      37.329     mm"
"             Runoff depth            34.472     65.577     34.472     mm"
"             Runoff volume           213.73     0.00       213.73     c.m"
"             Maximum flow            0.091      0.000      0.091      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.091     0.091     0.812     0.812"
================================================================
                          CATCHMENT 15
================================================================
" 33          CATCHMENT 15"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           15   ID number"
"        0.000   % Impervious"
"        0.250   Total Area"
"       18.000   Flow length"
"        2.860   Overland Slope"
"        0.250   Pervious Area"
"       18.000   Pervious length"
"        2.860   Pervious slope"
"        0.000   Impervious Area"
"       18.000   Impervious length"
"        2.860   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.049     0.091     0.812     0.812 c.m/sec"
"             Catchment 15            Pervious   Impervious Total Area "
"             Surface Area            0.250      0.000      0.250      hectare"
"             Time of concentration   7.586      1.008      7.586      minutes"
"             Time to Centroid        99.305     81.202     99.305     minutes"
"             Rainfall depth          71.801     71.801     71.801     mm"
"             Rainfall volume         179.50     0.00       179.50     c.m"
"             Rainfall losses         37.358     7.725      37.358     mm"
"             Runoff depth            34.443     64.076     34.443     mm"
"             Runoff volume           86.11      0.00       86.11      c.m"
"             Maximum flow            0.049      0.000      0.049      c.m/sec"
```

Midusss98 Steve Brown - AGM Engineering Ltd. Tuesday, June 01,2004, 11:46 AM

File Options Hydrology Hydrograph Design Show Automatic Tools Window Help

ROUTE

Last conduit

Type: Channel - triple

Channel depth: 1.000 metre

Gradient: 1.750 %

Manning's n: 0.040

Depth of flow: 0.203 metre

Flow capacity: 59.683 cu/secs

Using 31 branches of duration 31 seconds

Peak inflow: 0.924 c.m/sec

Reach length: 5 metre

K value: 0.052

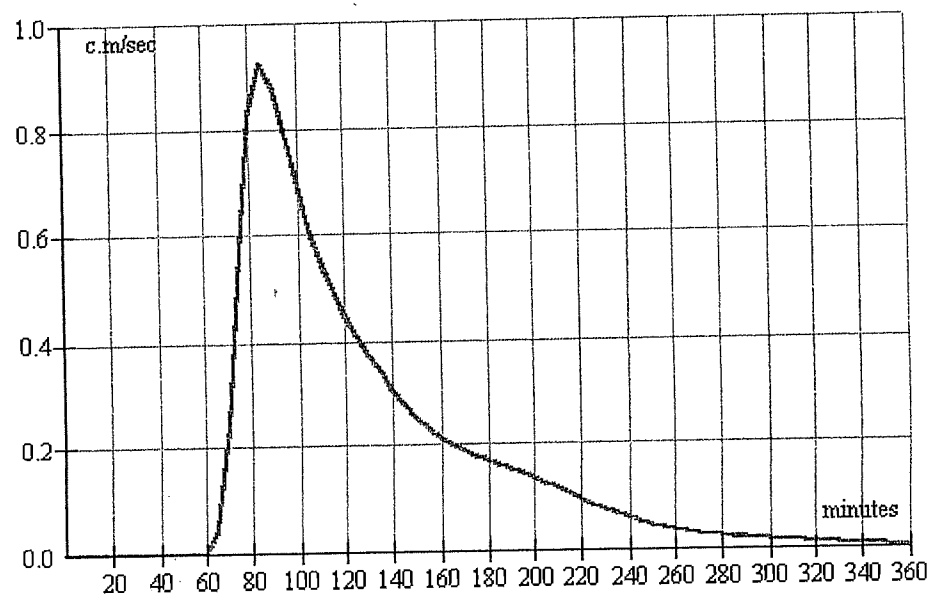
K is: 5 seconds

Peak outflow: 0.922 c.m/sec

Specify value for X and K

Route | Quick | Undo | Accept

Outflow Hydrograph



Plot duration 360 minutes

Outflow Hydrograph

Total volume: 3646.91 c.m Maximum flow: 0.922 c.m/sec 0.0 minutes

	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
5.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
55.0	0.000	0.001	0.048	0.242	0.564	0.822	0.922	0.884	0.793	0.695
105.0	0.612	0.548	0.496	0.451	0.411	0.374	0.340	0.308	0.278	0.253
155.0	0.232	0.215	0.201	0.190	0.180	0.172	0.165	0.157	0.149	0.140
205.0	0.130	0.119	0.109	0.098	0.088	0.078	0.069	0.061	0.054	0.048
255.0	0.043	0.039	0.035	0.032	0.029	0.026	0.024	0.022	0.021	0.019
305.0	0.017	0.016	0.015	0.014	0.012	0.011	0.010	0.009	0.008	0.008
355.0	0.007	0.006	0.005	0.005	0.004	0.004	0.003	0.003	0.002	0.002
405.0	0.002	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
455.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
505.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
555.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
605.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
655.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
705.0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

PEAK FLOWS (CU.M/SEC)

No	Command	Runoff	Inflow	Outflow	Junction
61	Channel Design	0.049	0.133	0.812	0.812
62	Channel Route 138	0.049	0.133	0.128	0.812
63	Combine 3	0.049	0.133	0.128	0.924
64	Confluence 3	0.049	0.924	0.128	0.000
65	Channel Design	0.049	0.924	0.128	0.000

Has options to define input and output files and control screen printing

Input: 100yrPRE.dat Manual Output: 100yrPRE.out

Start | AutoCAD Map 2000 - [13... | Midusss98 | Graphics Server | 11:46 AM

APPENDIX D

CATCHMENT AREA PLAN

MIDUSS OUTPUT

2 YEAR STORM – POST DEVELOPMENT

STARDUST DRIVE

STARLIGHT LANE

MOONLIGHT WAY

1	0.09	50%
2	0.40	50%
3	0.07	50%
4	0.40	40%
5	0.06	50%
6	0.40	40%
7	0.07	50%
8	0.12	50%
9	0.40	40%
10	0.60	40%
11	0.12	50%
12	0.07	50%
13	0.44	40%
14	.06	50%
15	0.46	40%
16	0.06	50%
17	0.46	40%
18	0.06	50%
19	0.46	40%
20	0.06	50%
21	0.46	40%
22	0.09	50%
23	0.44	40%
24	0.10	50%
25	0.47	40%
26	0.10	50%
27	0.10	50%
28	0.38	40%
29	0.17	50%
30	0.08	50%
31	0.10	0%
32	0.44	40%
33	0.07	50%
34	0.10	0%
35	0.44	40%
36	0.07	50%
37	0.10	0%
38	0.44	40%
39	0.07	50%
40	0.10	0%
41	0.44	40%
42	0.11	50%
43	0.11	50%
44	0.85	0%
45	0.57	40%
46	0.11	50%

00 — CATCHMENT
00 | 00.00 — % IMPERVIOUS
AREA (ha)

POST DEVELOPMENT CATCHMENT AREAS

SCALE 1:1500

DATE : MAY 31 2004

AGM SURVEYING • ENGINEERING
ARCHIBALD, GRAY & McKAY ENGINEERING LTD.
LONDON 685-5300

Plot date: Jun 08, 2004 G:\CLIENT\1133\1\DWG\1133-1135-1BASE.dwg

```
"               MIDUSS 98 Output---------------------------------------------->"
"               MIDUSS 98 version number                                  1.00"
"               MIDUSS 98 created                                 October 10, 2001"
"           10  Units used:                                             ie METRIC"
"               Project filename:                   G:\CLIENT\1133\1\MIDUSS\"
"               Output filename:                                    2yrpost1.Out"
"               Licensee name:                                       Steve Brown"
"               Company                                        AGM Engineering Ltd."
"               Date & Time last used:                      08/06/04 at 10:57:57 AM"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1200.000   Max. Hydrograph"
============================================================
                    2 YEAR STORM
============================================================
" 32          STORM Chicago storm"
"           1   Chicago storm"
"     724.690   Coefficient A"
"       5.500   Constant B"
"       0.800   Exponent C"
"       0.350   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          104.382    mm/hr"
"            Total depth                 33.312    mm"
"           6   002hyd   Hydrograph extension used in this file"
================================================================
                          CATCHMENT 1
================================================================
" 33          CATCHMENT 1"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"           1   ID number"
"      50.000   % Impervious"
"       0.090   Total Area"
"       5.750   Flow length"
"       2.000   Overland Slope"
"       0.045   Pervious Area"
"       5.750   Pervious length"
"       2.000   Pervious slope"
"       0.045   Impervious Area"
"       5.750   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      81.000   Pervious SCS Curve No."
"       0.258   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       5.958   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.850   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.010     0.000     0.000     0.000 c.m/sec"
"            Catchment 1           Pervious   Impervious Total Area "
"            Surface Area          0.045      0.045      0.090      hectare"
"            Time of concentration 8.860      0.847      2.779      minutes"
"            Time to Centroid      105.679    83.592     88.917     minutes"
"            Rainfall depth        33.312     33.312     33.312     mm"
"            Rainfall volume       14.99      14.99      29.98      c.m"
"            Rainfall losses       24.731     6.304      15.518     mm"
"            Runoff depth          8.581      27.008     17.794     mm"
"            Runoff volume         3.86       12.15      16.01      c.m"
"            Maximum flow          0.002      0.010      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                   0.010     0.010     0.000     0.000"
" 52          CHANNEL DESIGN"
"       0.010   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       1.500   Basewidth    metre"
"       2.000   Left bank slope"
"       2.000   Right bank slope"
"       0.900   Channel depth    metre"
"       0.500   Gradient   %"
"            Depth of flow                0.033    metre"
"            Velocity                     0.199    m/sec"
"            Channel capacity             3.967    c.m/sec"
"            Critical depth               0.017    metre"
" 53          ROUTE 72"
"       72.00   Reach length( metre)"
"       0.473   X-factor <= 0.5"
"     271.319   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     150.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 0.009    c.m/sec"
"                   0.010     0.010     0.009     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    1"
"           6   Combine "
"           1   Node #"
"               "
"            Maximum flow                 0.009    c.m/sec"
"            Hydrograph volume           16.015    c.m"
"                   0.010     0.010     0.009     0.009"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
```

```
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.008     0.010     0.001     0.000 c.m/sec"
"             Catchment 3            Pervious   Impervious Total Area "
"             Surface Area           0.035      0.035      0.070      hectare"
"             Time of concentration  8.860      0.847      2.779      minutes"
"             Time to Centroid       105.679    83.592     88.917     minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        11.66      11.66      23.32      c.m"
"             Rainfall losses        24.731     6.304      15.518     mm"
"             Runoff depth           8.581      27.008     17.794     mm"
"             Runoff volume          3.00       9.45       12.46      c.m"
"             Maximum flow           0.001      0.008      0.008      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.008     0.016     0.001     0.000"
" 52          CHANNEL DESIGN"
"        0.016   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                 0.043    metre"
"             Velocity                      0.236    m/sec"
"             Channel capacity              3.967    c.m/sec"
"             Critical depth                0.022    metre"
" 53          ROUTE 60"
"       60.20   Reach length( metre)"
"       0.458   X-factor <= 0.5"
"     191.124   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     150.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.015    c.m/sec"
"                  0.008     0.016     0.015     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"           6   Combine "
"           2   Node #"
"               "
"            Maximum flow                  0.015    c.m/sec"
"            Hydrograph volume            93.446    c.m"
"                  0.008     0.016     0.015     0.015"
" 40          HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                  0.008     0.000     0.015     0.015"
=============================================================
                          CATCHMENT 4
=============================================================
" 33          CATCHMENT 4"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"           3   ID number"
"       40.000   % Impervious"
"        0.400   Total Area"
"       60.200   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       60.200   Pervious length"
"        2.000   Pervious slope"
"        0.160   Impervious Area"
"       60.200   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.033     0.000     0.015     0.015 c.m/sec"
"             Catchment 3            Pervious   Impervious Total Area "
"             Surface Area           0.240      0.160      0.400      hectare"
"             Time of concentration  36.259     3.468      13.892     minutes"
"             Time to Centroid       138.336    87.562     103.703    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        79.95      53.30      133.25     c.m"
"             Rainfall losses        24.708     5.619      17.072     mm"
"             Runoff depth           8.604      27.693     16.240     mm"
"             Runoff volume          20.65      44.31      64.96      c.m"
"             Maximum flow           0.004      0.032      0.033      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.033     0.033     0.015     0.015"
" 54          POND DESIGN"
"        0.033   Current peak flow    c.m/sec"
"         65.0   Hydrograph volume    c.m/sec"
"           5.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
```

```
"              Hydrograph volume              169.098    c.m"
"                    0.007     0.020     0.019     0.019"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.007     0.000     0.019     0.019"
============================================================
                          CATCHMENT 6
============================================================
" 33           CATCHMENT 6"
"              1   Triangular SCS"
"              1   Equal length"
"              1   SCS method"
"              6   ID number"
"         40.000   % Impervious"
"          0.400   Total Area"
"         60.200   Flow length"
"          2.000   Overland Slope"
"          0.240   Pervious Area"
"         60.200   Pervious length"
"          2.000   Pervious slope"
"          0.160   Impervious Area"
"         60.200   Impervious length"
"          2.000   Impervious slope"
"          0.250   Pervious Manning 'n'"
"         81.000   Pervious SCS Curve No."
"          0.258   Pervious Runoff coefficient"
"          0.100   Pervious Ia/S coefficient"
"          5.958   Pervious Initial abstraction"
"          0.015   Impervious Manning 'n'"
"         98.000   Impervious SCS Curve No."
"          0.850   Impervious Runoff coefficient"
"          0.100   Impervious Ia/S coefficient"
"          0.518   Impervious Initial abstraction"
"                    0.033     0.000     0.019     0.019 c.m/sec"
"               Catchment 6             Pervious   Impervious Total Area "
"               Surface Area            0.240      0.160      0.400      hectare"
"               Time of concentration   36.259     3.468      13.892     minutes"
"               Time to Centroid        138.336    87.562     103.703    minutes"
"               Rainfall depth          33.312     33.312     33.312     mm"
"               Rainfall volume         79.95      53.30      133.25     c.m"
"               Rainfall losses         24.708     5.619      17.072     mm"
"               Runoff depth            8.604      27.693     16.240     mm"
"               Runoff volume           20.65      44.31      64.96      c.m"
"               Maximum flow            0.004      0.032      0.033      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.033     0.033     0.019     0.019"
" 54           POND DESIGN"
"          0.033   Current peak flow    c.m/sec"
"           65.0   Hydrograph volume    c.m/sec"
"             5.   Number of stages"
"          0.000   Minimum water level    c.m/sec"
"          0.750   Maximum water level    c.m/sec"
"              0   Keep Design Data: 1 = True; 0 = False"
"                    Level Discharge    Volume"
"                    0.000     0.000      0.0"
"                    0.300     0.001      0.1"
"                    0.450     0.001      4.7"
"                    0.600     0.001     37.1"
"                    0.750     0.001     75.0"
"              1.   ORIFICES"
"                   Orifice   Orifice   Orifice Number of"
"                    invert coefficie  diameter  orifices"
"                    0.000     0.600     0.025     1.000"
"                 Peak outflow                  0.001    c.m/sec"
"                 Maximum level                 0.661    metre"
"                 Maximum storage              52.585    c.m"
"                 Centroidal lag                9.870    hours"
"                    0.033     0.033     0.001     0.019 c.m/sec"
" 40           HYDROGRAPH   Combine    3"
"              6   Combine "
"              3   Node #"
"                  "
"                 Maximum flow                  0.020    c.m/sec"
"                 Hydrograph volume           234.073    c.m"
"                    0.033     0.033     0.001     0.020"
" 40           HYDROGRAPH   Confluence    3"
"              7   Confluence "
"              3   Node #"
"                  "
"                 Maximum flow                  0.020    c.m/sec"
"                 Hydrograph volume           234.073    c.m"
"                    0.033     0.020     0.001     0.000"
============================================================
                          CATCHMENT 7
============================================================
" 33           CATCHMENT 7"
"              1   Triangular SCS"
"              1   Equal length"
"              1   SCS method"
"              7   ID number"
"         50.000   % Impervious"
"          0.070   Total Area"
"          5.750   Flow length"
"          2.000   Overland Slope"
"          0.035   Pervious Area"
"          5.750   Pervious length"
"          2.000   Pervious slope"
"          0.035   Impervious Area"
"          5.750   Impervious length"
"          2.000   Impervious slope"
"          0.250   Pervious Manning 'n'"
```

```
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                  0.039    metre"
"             Velocity                       0.222    m/sec"
"             Channel capacity               3.967    c.m/sec"
"             Critical depth                 0.020    metre"
" 53          ROUTE 96"
"       96.00   Reach length( metre)"
"        0.452   X-factor <= 0.5"
"      162.278   K-lag    ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag    ( seconds)"
"        0.500   Beta weighting factor"
"      300.000   Routing time step    ( seconds)"
"            2   No. of sub-reaches"
"             Peak outflow                   0.013    c.m/sec"
"                   0.014     0.014     0.013     0.024 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                   0.037    c.m/sec"
"             Hydrograph volume            267.877    c.m"
"                   0.014     0.014     0.013     0.037"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.014     0.000     0.013     0.037"
"============================================================
                          CATCHMENT 9
============================================================
" 33          CATCHMENT 9"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            9   ID number"
"       40.000   % Impervious"
"        0.400   Total Area"
"       60.200   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       60.200   Pervious length"
"        2.000   Pervious slope"
"        0.160   Impervious Area"
"       60.200   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.033     0.000     0.013     0.037 c.m/sec"
"             Catchment 9          Pervious   Impervious Total Area "
"             Surface Area         0.240      0.160      0.400      hectare"
"             Time of concentration 36.259    3.468      13.892     minutes"
"             Time to Centroid     138.336    87.562     103.703    minutes"
"             Rainfall depth       33.312     33.312     33.312     mm"
"             Rainfall volume      79.95      53.30      133.25     c.m"
"             Rainfall losses      24.708     5.619      17.072     mm"
"             Runoff depth         8.604      27.693     16.240     mm"
"             Runoff volume        20.65      44.31      64.96      c.m"
"             Maximum flow         0.004      0.032      0.033      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.033     0.033     0.013     0.037"
============================================================
                          CATCHMENT 10
============================================================
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   ID number"
"       40.000   % Impervious"
"        0.600   Total Area"
"       89.800   Flow length"
"        2.000   Overland Slope"
"        0.360   Pervious Area"
"       89.800   Pervious length"
"        2.000   Pervious slope"
"        0.240   Impervious Area"
"       89.800   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
```

```
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.014     0.000     0.038     0.038 c.m/sec"
"             Catchment 11           Pervious   Impervious Total Area "
"             Surface Area           0.060      0.060      0.120      hectare"
"             Time of concentration  8.860      0.847      2.779      minutes"
"             Time to Centroid       105.679    83.592     88.917     minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        19.99      19.99      39.97      c.m"
"             Rainfall losses        24.731     6.304      15.518     mm"
"             Runoff depth           8.581      27.008     17.794     mm"
"             Runoff volume          5.15       16.20      21.35      c.m"
"             Maximum flow           0.002      0.013      0.014      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.014     0.014     0.038     0.038"
" 52          CHANNEL DESIGN"
"        0.014   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                  0.039    metre"
"             Velocity                       0.222    m/sec"
"             Channel capacity               3.967    c.m/sec"
"             Critical depth                 0.020    metre"
" 53          ROUTE 96"
"       96.00   Reach length( metre)"
"        0.452  X-factor <= 0.5"
"      162.278  K-lag   ( seconds)"
"        0.000  Default(0) or user spec.(1) values used"
"        0.500  X-factor <= 0.5"
"       30.000  K-lag   ( seconds)"
"        0.500  Beta weighting factor"
"      300.000  Routing time step   ( seconds)"
"            2  No. of sub-reaches"
"             Peak outflow                   0.013    c.m/sec"
"                  0.014     0.014     0.013     0.038 c.m/sec"
" 40          HYDROGRAPH   Combine    5"
"            6   Combine "
"            5   Node #"
"                "
"             Maximum flow                   0.051    c.m/sec"
"             Hydrograph volume              362.869  c.m"
"                  0.014     0.014     0.013     0.051"
" 40          HYDROGRAPH   Confluence    5"
"            7   Confluence "
"            5   Node #"
"                "
"             Maximum flow                   0.051    c.m/sec"
"             Hydrograph volume              362.869  c.m"
"                  0.014     0.051     0.013     0.000"
================================================================
                          CATCHMENT 12
================================================================
" 33          CATCHMENT 12"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           12   ID number"
"       50.000   % Impervious"
"        0.070   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.035   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.035   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.008     0.051     0.013     0.000 c.m/sec"
"             Catchment 12           Pervious   Impervious Total Area "
"             Surface Area           0.035      0.035      0.070      hectare"
"             Time of concentration  8.860      0.847      2.779      minutes"
"             Time to Centroid       105.679    83.592     88.917     minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        11.66      11.66      23.32      c.m"
"             Rainfall losses        24.731     6.304      15.518     mm"
"             Runoff depth           8.581      27.008     17.794     mm"
"             Runoff volume          3.00       9.45       12.46      c.m"
```

```
"                0.036     0.036     0.001     0.052 c.m/sec"
" 40          HYDROGRAPH   Combine    6"
"            6   Combine "
"            6   Node #"
"                "
"             Maximum flow                    0.053    c.m/sec"
"             Hydrograph volume             442.894    c.m"
"                    0.036     0.036     0.001     0.053"
" 40          HYDROGRAPH   Confluence    6"
"            7   Confluence "
"            6   Node #"
"                "
"             Maximum flow                    0.053    c.m/sec"
"             Hydrograph volume             442.894    c.m"
"                    0.036     0.053     0.001     0.000"
================================================================
                            CATCHMENT 14
================================================================
" 33          CATCHMENT 14"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           14   ID number"
"       50.000   % Impervious"
"        0.060   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.030   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.030   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.007     0.053     0.001     0.000 c.m/sec"
"             Catchment 14           Pervious   Impervious Total Area "
"             Surface Area           0.030      0.030      0.060      hectare"
"             Time of concentration  8.860      0.847      2.779      minutes"
"             Time to Centroid       105.679    83.592     88.917     minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        9.99       9.99       19.99      c.m"
"             Rainfall losses        24.731     6.304      15.518     mm"
"             Runoff depth           8.581      27.008     17.794     mm"
"             Runoff volume          2.57       8.10       10.68      c.m"
"             Maximum flow           0.001      0.007      0.007      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.007     0.056     0.001     0.000"
" 52          CHANNEL DESIGN"
"        0.056   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.420   Gradient   %"
"             Depth of flow                  0.095    metre"
"             Velocity                       0.353    m/sec"
"             Channel capacity               3.636    c.m/sec"
"             Critical depth                 0.051    metre"
" 53          ROUTE 56"
"       56.10   Reach length( metre)"
"        0.382   X-factor <= 0.5"
"      119.226   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.052    c.m/sec"
"                    0.007     0.056     0.052     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    7"
"            6   Combine "
"            7   Node #"
"                "
"             Maximum flow                   0.052    c.m/sec"
"             Hydrograph volume            453.306    c.m"
"                    0.007     0.056     0.052     0.052"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.007     0.000     0.052     0.052"
================================================================
                            CATCHMENT 15
================================================================
" 33          CATCHMENT 15"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           15   ID number"
"       40.000   % Impervious"
"        0.460   Total Area"
```

```
"            Rainfall volume          9.99        9.99        19.99       c.m"
"            Rainfall losses          24.731      6.304       15.518      mm"
"            Runoff depth             8.581       27.008      17.794      mm"
"            Runoff volume            2.57        8.10        10.68       c.m"
"            Maximum flow             0.001       0.007       0.007       c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.007     0.056     0.001     0.000"
" 52         CHANNEL DESIGN"
"       0.056   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       1.500   Basewidth    metre"
"       2.000   Left bank slope"
"       2.000   Right bank slope"
"       0.900   Channel depth    metre"
"       0.420   Gradient   %"
"            Depth of flow                0.095    metre"
"            Velocity                     0.353    m/sec"
"            Channel capacity             3.636    c.m/sec"
"            Critical depth               0.051    metre"
" 53         ROUTE 56"
"       56.10   Reach length( metre)"
"       0.382   X-factor <= 0.5"
"     119.275   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     100.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 0.056    c.m/sec"
"                 0.007     0.056     0.056     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    8"
"           6   Combine "
"           8   Node #"
"               "
"            Maximum flow                 0.056    c.m/sec"
"            Hydrograph volume            532.031  c.m"
"                 0.007     0.056     0.056     0.056"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                 0.007     0.000     0.056     0.056"
================================================================
                        CATCHMENT 17
================================================================
" 33         CATCHMENT 17"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          17   ID number"
"      40.000   % Impervious"
"       0.460   Total Area"
"      56.100   Flow length"
"       2.000   Overland Slope"
"       0.276   Pervious Area"
"      56.100   Pervious length"
"       2.000   Pervious slope"
"       0.184   Impervious Area"
"      56.100   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      81.000   Pervious SCS Curve No."
"       0.258   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       5.958   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.850   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                 0.038     0.000     0.056     0.056 c.m/sec"
"            Catchment 17           Pervious   Impervious Total Area "
"            Surface Area           0.276      0.184      0.460      hectare"
"            Time of concentration  34.756     3.324      13.302     minutes"
"            Time to Centroid       136.551    87.301     102.935    minutes"
"            Rainfall depth         33.312     33.312     33.312     mm"
"            Rainfall volume        91.94      61.29      153.23     c.m"
"            Rainfall losses        24.711     5.571      17.055     mm"
"            Runoff depth           8.601      27.741     16.257     mm"
"            Runoff volume          23.74      51.04      74.78      c.m"
"            Maximum flow           0.005      0.037      0.038      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.038     0.038     0.056     0.056"
" 54         POND DESIGN"
"       0.038   Current peak flow    c.m/sec"
"        75.0   Hydrograph volume    c.m/sec"
"          5.   Number of stages"
"       0.000   Minimum water level    c.m/sec"
"       0.750   Maximum water level    c.m/sec"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                 0.000     0.000      0.0"
"                 0.300     0.001      0.1"
"                 0.450     0.001      4.7"
"                 0.600     0.001     37.1"
"                 0.750     0.001     75.0"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                 0.000     0.600     0.025     1.000"
```

```
"            1   SCS method"
"           19   ID number"
"       40.000   % Impervious"
"        0.460   Total Area"
"       56.100   Flow length"
"        2.000   Overland Slope"
"        0.276   Pervious Area"
"       56.100   Pervious length"
"        2.000   Pervious slope"
"        0.184   Impervious Area"
"       56.100   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.038     0.000     0.058     0.058 c.m/sec"
"             Catchment 19           Pervious   Impervious Total Area "
"             Surface Area           0.276      0.184      0.460      hectare"
"             Time of concentration  34.756     3.324      13.302     minutes"
"             Time to Centroid       136.551    87.301     102.935    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        91.94      61.29      153.23     c.m"
"             Rainfall losses        24.711     5.571      17.055     mm"
"             Runoff depth           8.601      27.741     16.257     mm"
"             Runoff volume          23.74      51.04      74.78      c.m"
"             Maximum flow           0.005      0.037      0.038      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.038     0.038     0.058     0.058"
" 54          POND DESIGN"
"        0.038   Current peak flow    c.m/sec"
"         75.0   Hydrograph volume    c.m/sec"
"           5.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000      0.0"
"                  0.300     0.001      0.1"
"                  0.450     0.001      4.7"
"                  0.600     0.001     37.1"
"                  0.750     0.001     75.0"
"          1.   ORIFICES"
"               Orifice   Orifice   Orifice Number of"
"                invert coefficie  diameter  orifices"
"                 0.000     0.600     0.025     1.000"
"             Peak outflow                    0.001    c.m/sec"
"             Maximum level                   0.698    metre"
"             Maximum storage                61.910    c.m"
"             Centroidal lag                 10.917   hours"
"                  0.038     0.038     0.001     0.058 c.m/sec"
" 40          HYDROGRAPH   Combine    9"
"            6   Combine "
"            9   Node #"
"                "
"             Maximum flow                     0.059    c.m/sec"
"             Hydrograph volume              679.132    c.m"
"                   0.038     0.038     0.001     0.059"
" 40          HYDROGRAPH   Confluence    9"
"            7   Confluence "
"            9   Node #"
"                "
"             Maximum flow                     0.059    c.m/sec"
"             Hydrograph volume              679.132    c.m"
"                   0.038     0.059     0.001     0.000"
=============================================================
                          CATCHMENT 20
=============================================================
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   ID number"
"       50.000   % Impervious"
"        0.060   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.030   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.030   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.007     0.059     0.001     0.000 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
```

```
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                   0.000     0.600     0.025     1.000"
"              Peak outflow                   0.001    c.m/sec"
"              Maximum level                  0.698    metre"
"              Maximum storage               61.910    c.m"
"              Centroidal lag                10.917   hours"
"                   0.038     0.038     0.001     0.060 c.m/sec"
" 40          HYDROGRAPH   Combine    10"
"              6   Combine "
"             10   Node #"
"                  "
"              Maximum flow                   0.061    c.m/sec"
"              Hydrograph volume            757.772    c.m"
"                    0.038     0.038     0.001     0.061"
" 40          HYDROGRAPH   Confluence    10"
"              7   Confluence "
"             10   Node #"
"                  "
"              Maximum flow                   0.061    c.m/sec"
"              Hydrograph volume            757.772    c.m"
"                    0.038     0.061     0.001     0.000"
" 52           CHANNEL DESIGN"
"          0.061   Current peak flow    c.m/sec"
"          0.035   Manning 'n'"
"             0.   Cross-section type: 0=trapezoidal; 1=general"
"          1.500   Basewidth    metre"
"          2.000   Left bank slope"
"          2.000   Right bank slope"
"          0.900   Channel depth    metre"
"          1.000   Gradient   %"
"               Depth of flow                 0.077    metre"
"               Velocity                      0.481    m/sec"
"               Channel capacity              5.610    c.m/sec"
"               Critical depth                0.054    metre"
" 53           ROUTE 17"
"          17.00   Reach length( metre)"
"          0.366   X-factor <= 0.5"
"         26.486   K-lag    ( seconds)"
"          0.000   Default(0) or user spec.(1) values used"
"          0.500   X-factor <= 0.5"
"         30.000   K-lag    ( seconds)"
"          0.500   Beta weighting factor"
"         33.333   Routing time step    ( seconds)"
"              1   No. of sub-reaches"
"               Peak outflow                  0.061    c.m/sec"
"                     0.038     0.061     0.061     0.000 c.m/sec"
" 40           HYDROGRAPH   Combine    11"
"              6   Combine "
"             11   Node #"
"                  "
"              Maximum flow                   0.061    c.m/sec"
"              Hydrograph volume            757.598    c.m"
"                    0.038     0.061     0.061     0.061"
" 40           HYDROGRAPH Start - New Tributary"
"              2   Start - New Tributary"
"                    0.038     0.000     0.061     0.061"
" 33           CATCHMENT 24"
"              1   Triangular SCS"
"              1   Equal length"
"              1   SCS method"
"             24   ID number"
"          50.000   % Impervious"
"           0.100   Total Area"
"           5.750   Flow length"
"           2.000   Overland Slope"
"           0.050   Pervious Area"
"           5.750   Pervious length"
"           2.000   Pervious slope"
"           0.050   Impervious Area"
"           5.750   Impervious length"
"           2.000   Impervious slope"
"           0.250   Pervious Manning 'n'"
"          81.000   Pervious SCS Curve No."
"           0.258   Pervious Runoff coefficient"
"           0.100   Pervious Ia/S coefficient"
"           5.958   Pervious Initial abstraction"
"           0.015   Impervious Manning 'n'"
"          98.000   Impervious SCS Curve No."
"           0.850   Impervious Runoff coefficient"
"           0.100   Impervious Ia/S coefficient"
"           0.518   Impervious Initial abstraction"
"                     0.011     0.000     0.061     0.061 c.m/sec"
"               Catchment 24           Pervious   Impervious Total Area "
"               Surface Area           0.050      0.050      0.100      hectare"
"               Time of concentration  8.860      0.847      2.779      minutes"
"               Time to Centroid       105.679    83.592     88.917     minutes"
"               Rainfall depth         33.312     33.312     33.312     mm"
"               Rainfall volume        16.66      16.66      33.31      c.m"
"               Rainfall losses        24.731     6.304      15.518     mm"
"               Runoff depth           8.581      27.008     17.794     mm"
"               Runoff volume          4.29       13.50      17.79      c.m"
"               Maximum flow           0.002      0.011      0.011      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.011     0.011     0.061     0.061"
" 52           CHANNEL DESIGN"
"           0.011   Current peak flow    c.m/sec"
"           0.035   Manning 'n'"
"              0.   Cross-section type: 0=trapezoidal; 1=general"
"           1.500   Basewidth    metre"
```

CATCHMENT 26

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============================================================
" 33          CATCHMENT 26"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           26   ID number"
"       50.000   % Impervious"
"        0.100   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.050   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.050   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.011     0.000     0.001     0.011 c.m/sec"
"             Catchment 26          Pervious   Impervious Total Area "
"             Surface Area          0.050      0.050      0.100      hectare"
"             Time of concentration 8.860      0.847      2.779      minutes"
"             Time to Centroid      105.679    83.592     88.917     minutes"
"             Rainfall depth        33.312     33.312     33.312     mm"
"             Rainfall volume       16.66      16.66      33.31      c.m"
"             Rainfall losses       24.731     6.304      15.518     mm"
"             Runoff depth          8.581      27.008     17.794     mm"
"             Runoff volume         4.29       13.50      17.79      c.m"
"             Maximum flow          0.002      0.011      0.011      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.011     0.011     0.001     0.011"
" 52          CHANNEL DESIGN"
"        0.011   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                 0.035    metre"
"             Velocity                      0.207    m/sec"
"             Channel capacity              3.967    c.m/sec"
"             Critical depth                0.018    metre"
" 53          ROUTE 78"
"       78.00   Reach length( metre)"
"       0.474   X-factor <= 0.5"
"     282.444   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     150.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"             Peak outflow                  0.010    c.m/sec"
"                   0.011     0.011     0.010     0.011 c.m/sec"
" 40          HYDROGRAPH   Combine    12"
"            6   Combine "
"           12   Node #"
"                "
"             Maximum flow                  0.021    c.m/sec"
"             Hydrograph volume           104.833    c.m"
"                   0.011     0.011     0.010     0.021"
" 40          HYDROGRAPH   Confluence    12"
"            7   Confluence "
"           12   Node #"
"                "
"             Maximum flow                  0.021    c.m/sec"
"             Hydrograph volume           104.833    c.m"
"                   0.011     0.021     0.010     0.000"
" 51          PIPE DESIGN"
"        0.021   Current peak flow    c.m/sec"
"        0.015   Manning 'n'"
"        0.450   Diameter    metre"
"        0.500   Gradient   %"
"             Depth of flow                 0.106    metre"
"             Velocity                      0.742    m/sec"
"             Pipe capacity                 0.175    c.m/sec"
"             Critical depth                0.098    metre"
" 53          ROUTE 20"
"       20.00   Reach length( metre)"
"       0.229   X-factor <= 0.5"
"      20.214   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      30.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"             Peak outflow                  0.020    c.m/sec"
"                   0.011     0.021     0.020     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    13"
```

```
"       73.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.031     0.000     0.010     0.030 c.m/sec"
"             Catchment 28           Pervious   Impervious Total Area "
"             Surface Area           0.228      0.152      0.380      hectare"
"             Time of concentration  40.705     3.893      15.556     minutes"
"             Time to Centroid       143.648    88.168     105.746    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        75.95      50.63      126.58     c.m"
"             Rainfall losses        24.709     5.488      17.021     mm"
"             Runoff depth           8.602      27.824     16.291     mm"
"             Runoff volume          19.61      42.29      61.91      c.m"
"             Maximum flow           0.004      0.031      0.031      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.031     0.031     0.010     0.030"
" 54          POND DESIGN"
"       0.031   Current peak flow    c.m/sec"
"        62.0   Hydrograph volume    c.m/sec"
"          5.   Number of stages"
"       0.000   Minimum water level    c.m/sec"
"       0.750   Maximum water level    c.m/sec"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                 0.000     0.000      0.0"
"                 0.188     0.001      1.0"
"                 0.375     0.001      4.0"
"                 0.563     0.001     30.0"
"                 0.750     0.001     70.0"
"             Peak outflow                  0.001    c.m/sec"
"             Maximum level                 1.#IO    metre"
"             Maximum storage               1.#IO    c.m"
"             Centroidal lag                9.435    hours"
"                  0.031     0.031     0.001     0.030 c.m/sec"
" 40          HYDROGRAPH   Combine    13"
"            6   Combine "
"           13   Node #"
"                "
"             Maximum flow                  0.031    c.m/sec"
"             Hydrograph volume           184.506    c.m"
"                    0.031     0.031     0.001     0.031"
" 40          HYDROGRAPH   Confluence    13"
"            7   Confluence "
"           13   Node #"
"                "
"             Maximum flow                  0.031    c.m/sec"
"             Hydrograph volume           184.506    c.m"
"                    0.031     0.031     0.001     0.000"
================================================================
                          CATCHMENT 29
================================================================
" 33          CATCHMENT 29"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           29   ID number"
"       50.000   % Impervious"
"        0.170   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.085   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.085   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.019     0.031     0.001     0.000 c.m/sec"
"             Catchment 29           Pervious   Impervious Total Area "
"             Surface Area           0.085      0.085      0.170      hectare"
"             Time of concentration  8.860      0.847      2.779      minutes"
"             Time to Centroid       105.679    83.592     88.917     minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        28.32      28.32      56.63      c.m"
"             Rainfall losses        24.731     6.304      15.518     mm"
"             Runoff depth           8.581      27.008     17.794     mm"
"             Runoff volume          7.29       22.96      30.25      c.m"
"             Maximum flow           0.003      0.019      0.019      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.019     0.046     0.001     0.000"
" 52          CHANNEL DESIGN"
"        0.046   Current peak flow    c.m/sec"
```

```
"                    0.009     0.000     0.045     0.045"
================================================================
                          CATCHMENT 31
================================================================
" 33          CATCHMENT 31"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           31   ID number"
"        0.000   % Impervious"
"        0.100   Total Area"
"       17.000   Flow length"
"        2.000   Overland Slope"
"        0.100   Pervious Area"
"       17.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       17.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.003     0.000     0.045     0.045 c.m/sec"
"             Catchment 31           Pervious   Impervious Total Area "
"             Surface Area           0.100      0.000      0.100      hectare"
"             Time of concentration  16.979     1.624      16.979     minutes"
"             Time to Centroid       115.358    84.509     115.358    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        33.31      0.00       33.31      c.m"
"             Rainfall losses        24.712     5.402      24.712     mm"
"             Runoff depth           8.600      27.910     8.600      mm"
"             Runoff volume          8.60       0.00       8.60       c.m"
"             Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.003     0.003     0.045     0.045"
================================================================
                          CATCHMENT 32
================================================================
" 33          CATCHMENT 32"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           32   ID number"
"       40.000   % Impervious"
"        0.440   Total Area"
"       59.700   Flow length"
"        2.000   Overland Slope"
"        0.264   Pervious Area"
"       59.700   Pervious length"
"        2.000   Pervious slope"
"        0.176   Impervious Area"
"       59.700   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.036     0.003     0.045     0.045 c.m/sec"
"             Catchment 32           Pervious   Impervious Total Area "
"             Surface Area           0.264      0.176      0.440      hectare"
"             Time of concentration  36.078     3.451      13.821     minutes"
"             Time to Centroid       138.121    87.530     103.610    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        87.94      58.63      146.57     c.m"
"             Rainfall losses        24.708     5.611      17.069     mm"
"             Runoff depth           8.604      27.700     16.243     mm"
"             Runoff volume          22.71      48.75      71.47      c.m"
"             Maximum flow           0.005      0.036      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.036     0.038     0.045     0.045"
" 54          POND DESIGN"
"        0.038   Current peak flow    c.m/sec"
"         81.0   Hydrograph volume    c.m/sec"
"           5.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000      0.0"
"                  0.300     0.001      0.1"
"                  0.450     0.001      4.7"
"                  0.600     0.001     37.1"
"                  0.750     0.001     75.0"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                  0.000     0.600     0.025     1.000"
```

```
"            1   SCS method"
"           34   ID number"
"        0.000   % Impervious"
"        0.100   Total Area"
"       17.000   Flow length"
"        2.000   Overland Slope"
"        0.100   Pervious Area"
"       17.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       17.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.003     0.000     0.049     0.049 c.m/sec"
"             Catchment 34           Pervious   Impervious Total Area "
"             Surface Area           0.100      0.000      0.100      hectare"
"             Time of concentration  16.979     1.624      16.979     minutes"
"             Time to Centroid       115.358    84.509     115.358    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        33.31      0.00       33.31      c.m"
"             Rainfall losses        24.712     5.402      24.712     mm"
"             Runoff depth           8.600      27.910     8.600      mm"
"             Runoff volume          8.60       0.00       8.60       c.m"
"             Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.003     0.003     0.049     0.049"
================================================================
                          CATCHMENT 35
================================================================
" 33          CATCHMENT 35"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           35   ID number"
"       40.000   % Impervious"
"        0.440   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        0.264   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.176   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.036     0.003     0.049     0.049 c.m/sec"
"             Catchment 35           Pervious   Impervious Total Area "
"             Surface Area           0.264      0.176      0.440      hectare"
"             Time of concentration  36.186     3.461      13.863     minutes"
"             Time to Centroid       138.250    87.549     103.665    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        87.94      58.63      146.57     c.m"
"             Rainfall losses        24.708     5.616      17.071     mm"
"             Runoff depth           8.604      27.696     16.241     mm"
"             Runoff volume          22.71      48.75      71.46      c.m"
"             Maximum flow           0.005      0.036      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.036     0.038     0.049     0.049"
" 54          POND DESIGN"
"        0.038   Current peak flow    c.m/sec"
"         81.0   Hydrograph volume    c.m/sec"
"           5.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000      0.0"
"                  0.300     0.001      0.1"
"                  0.450     0.001      4.7"
"                  0.600     0.001     37.1"
"                  0.750     0.001     75.0"
"              1.  ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                    0.000     0.600     0.025     1.000"
"             Peak outflow                    0.001    c.m/sec"
"             Maximum level                   0.718    metre"
"             Maximum storage                66.863    c.m"
"             Centroidal lag                 11.401    hours"
"                  0.036     0.038     0.001     0.049 c.m/sec"
" 40          HYDROGRAPH   Combine    15"
"            6   Combine "
```

```
"       17.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       17.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.003     0.000     0.052     0.052 c.m/sec"
"             Catchment 37           Pervious   Impervious Total Area "
"             Surface Area           0.100      0.000      0.100      hectare"
"             Time of concentration  16.979     1.624      16.979     minutes"
"             Time to Centroid       115.358    84.509     115.358    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        33.31      0.00       33.31      c.m"
"             Rainfall losses        24.712     5.402      24.712     mm"
"             Runoff depth           8.600      27.910     8.600      mm"
"             Runoff volume          8.60       0.00       8.60       c.m"
"             Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.003     0.003     0.052     0.052"
============================================================
                        CATCHMENT 38
============================================================
" 33          CATCHMENT 38"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          38   ID number"
"       40.000   % Impervious"
"        0.440   Total Area"
"       60.000   Flow length"
"        2.000   Overland Slope"
"        0.264   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.176   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.036     0.003     0.052     0.052 c.m/sec"
"             Catchment 38           Pervious   Impervious Total Area "
"             Surface Area           0.264      0.176      0.440      hectare"
"             Time of concentration  36.186     3.461      13.863     minutes"
"             Time to Centroid       138.250    87.549     103.665    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        87.94      58.63      146.57     c.m"
"             Rainfall losses        24.708     5.616      17.071     mm"
"             Runoff depth           8.604      27.696     16.241     mm"
"             Runoff volume          22.71      48.75      71.46      c.m"
"             Maximum flow           0.005      0.036      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                  0.036     0.038     0.052     0.052"
" 54          POND DESIGN"
"        0.038   Current peak flow    c.m/sec"
"         81.0   Hydrograph volume    c.m/sec"
"           5.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000      0.0"
"                  0.300     0.001      0.1"
"                  0.450     0.001      4.7"
"                  0.600     0.001     37.1"
"                  0.750     0.001     75.0"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                   0.000     0.600     0.025     1.000"
"               Peak outflow                      0.001    c.m/sec"
"               Maximum level                     0.718    metre"
"               Maximum storage                  66.863    c.m"
"               Centroidal lag                   11.401    hours"
"                  0.036     0.038     0.001     0.052 c.m/sec"
" 40          HYDROGRAPH   Combine    16"
"           6   Combine "
"          16   Node #"
"               "
"               Maximum flow                      0.053    c.m/sec"
"               Hydrograph volume               461.514    c.m"
"                  0.036     0.038     0.001     0.053"
" 40          HYDROGRAPH   Confluence    16"
"           7   Confluence "
```

```
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.850   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.003     0.000     0.054     0.054 c.m/sec"
"              Catchment 40           Pervious   Impervious Total Area "
"              Surface Area           0.100      0.000      0.100      hectare"
"              Time of concentration  16.979     1.624      16.979     minutes"
"              Time to Centroid       115.358    84.509     115.358    minutes"
"              Rainfall depth         33.312     33.312     33.312     mm"
"              Rainfall volume        33.31      0.00       33.31      c.m"
"              Rainfall losses        24.712     5.402      24.712     mm"
"              Runoff depth           8.600      27.910     8.600      mm"
"              Runoff volume          8.60       0.00       8.60       c.m"
"              Maximum flow           0.003      0.000      0.003      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.003     0.003     0.054     0.054"
=============================================================
                          CATCHMENT 41
=============================================================
" 33           CATCHMENT 41"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            41   ID number"
"        40.000   % Impervious"
"         0.440   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         0.264   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.176   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.258   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.850   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                   0.036     0.003     0.054     0.054 c.m/sec"
"              Catchment 41           Pervious   Impervious Total Area "
"              Surface Area           0.264      0.176      0.440      hectare"
"              Time of concentration  36.186     3.461      13.863     minutes"
"              Time to Centroid       138.250    87.549     103.665    minutes"
"              Rainfall depth         33.312     33.312     33.312     mm"
"              Rainfall volume        87.94      58.63      146.57     c.m"
"              Rainfall losses        24.708     5.616      17.071     mm"
"              Runoff depth           8.604      27.696     16.241     mm"
"              Runoff volume          22.71      48.75      71.46      c.m"
"              Maximum flow           0.005      0.036      0.036      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.036     0.038     0.054     0.054"
" 54           POND DESIGN"
"         0.038   Current peak flow    c.m/sec"
"          81.0   Hydrograph volume    c.m/sec"
"            5.   Number of stages"
"         0.000   Minimum water level    c.m/sec"
"         0.750   Maximum water level    c.m/sec"
"             0   Keep Design Data: 1 = True; 0 = False"
"                   Level Discharge    Volume"
"                   0.000     0.000      0.0"
"                   0.300     0.001      0.1"
"                   0.450     0.001      4.7"
"                   0.600     0.001     37.1"
"                   0.750     0.001     75.0"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                   0.000     0.600     0.025     1.000"
"              Peak outflow                      0.001    c.m/sec"
"              Maximum level                     0.718    metre"
"              Maximum storage                  66.863    c.m"
"              Centroidal lag                   11.401    hours"
"                   0.036     0.038     0.001     0.054 c.m/sec"
" 40           HYDROGRAPH   Combine    17"
"             6   Combine "
"            17   Node #"
"                 "
"              Maximum flow                      0.055    c.m/sec"
"              Hydrograph volume               543.224    c.m"
"                   0.036     0.038     0.001     0.055"
" 40           HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                   0.036     0.000     0.001     0.055"
=============================================================
                          CATCHMENT 42
=============================================================
" 33           CATCHMENT 42"
"             1   Triangular SCS"
"             1   Equal length"
```

```
"           18   Node #"
"                "
"             Maximum flow                  0.061    c.m/sec"
"             Hydrograph volume           562.638    c.m"
"                    0.012     0.061      0.061     0.061"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.012     0.000      0.061     0.061"
================================================================
                          CATCHMENT 43
================================================================
" 33          CATCHMENT 43"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           43   ID number"
"       50.000   % Impervious"
"        0.110   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.055   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.055   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.012     0.000      0.061     0.061 c.m/sec"
"             Catchment 43          Pervious   Impervious Total Area "
"             Surface Area          0.055      0.055      0.110      hectare"
"             Time of concentration 8.860      0.847      2.779      minutes"
"             Time to Centroid      105.679    83.592     88.917     minutes"
"             Rainfall depth        33.312     33.312     33.312     mm"
"             Rainfall volume       18.32      18.32      36.64      c.m"
"             Rainfall losses       24.731     6.304      15.518     mm"
"             Runoff depth          8.581      27.008     17.794     mm"
"             Runoff volume         4.72       14.85      19.57      c.m"
"             Maximum flow          0.002      0.012      0.012      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.012     0.012      0.061     0.061"
" 52          CHANNEL DESIGN"
"        0.012   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        3.000   Gradient   %"
"             Depth of flow                 0.021    metre"
"             Velocity                      0.374    m/sec"
"             Channel capacity              9.717    c.m/sec"
"             Critical depth                0.019    metre"
" 53          ROUTE 93"
"       93.00   Reach length( metre)"
"        0.498   X-factor <= 0.5"
"      186.651   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      150.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.011    c.m/sec"
"                    0.012     0.012      0.011     0.061 c.m/sec"
" 40          HYDROGRAPH   Combine    18"
"            6   Combine "
"           18   Node #"
"                "
"             Maximum flow                  0.066    c.m/sec"
"             Hydrograph volume           582.212    c.m"
"                    0.012     0.012      0.011     0.066"
" 40          HYDROGRAPH   Confluence    18"
"            7   Confluence "
"           18   Node #"
"                "
"             Maximum flow                  0.066    c.m/sec"
"             Hydrograph volume           582.212    c.m"
"                    0.012     0.066      0.011     0.000"
" 52          CHANNEL DESIGN"
"        0.066   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.700   Gradient   %"
"             Depth of flow                 0.090    metre"
"             Velocity                      0.441    m/sec"
"             Channel capacity              4.694    c.m/sec"
"             Critical depth                0.057    metre"
```

```
"        0.045   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.010     0.000     0.126     0.126 c.m/sec"
"             Catchment 22           Pervious   Impervious Total Area "
"             Surface Area           0.045      0.045      0.090      hectare"
"             Time of concentration  8.860      0.847      2.779      minutes"
"             Time to Centroid       105.679    83.592     88.917     minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        14.99      14.99      29.98      c.m"
"             Rainfall losses        24.731     6.304      15.518     mm"
"             Runoff depth           8.581      27.008     17.794     mm"
"             Runoff volume          3.86       12.15      16.01      c.m"
"             Maximum flow           0.002      0.010      0.010      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.010     0.010     0.126     0.126"
" 52          CHANNEL DESIGN"
"        0.010   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                 0.033    metre"
"             Velocity                      0.199    m/sec"
"             Channel capacity              3.967    c.m/sec"
"             Critical depth                0.017    metre"
" 53          ROUTE 32"
"        32.00   Reach length( metre)"
"        0.439   X-factor <= 0.5"
"      120.586   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.009    c.m/sec"
"                    0.010     0.010     0.009     0.126 c.m/sec"
" 40          HYDROGRAPH   Combine    19"
"            6   Combine "
"           19   Node #"
"                "
"             Maximum flow                  0.130    c.m/sec"
"             Hydrograph volume          1355.317    c.m"
"                    0.010     0.010     0.009     0.130"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.010     0.000     0.009     0.130"
================================================================
                          CATCHMENT 23
================================================================
" 33          CATCHMENT 23"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            23   ID number"
"       40.000   % Impervious"
"        0.440   Total Area"
"       56.300   Flow length"
"        2.000   Overland Slope"
"        0.264   Pervious Area"
"       56.300   Pervious length"
"        2.000   Pervious slope"
"        0.176   Impervious Area"
"       56.300   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.258   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.850   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.036     0.000     0.009     0.130 c.m/sec"
"             Catchment 23           Pervious   Impervious Total Area "
"             Surface Area           0.264      0.176      0.440      hectare"
"             Time of concentration  34.830     3.331      13.331     minutes"
"             Time to Centroid       136.639    87.314     102.972    minutes"
"             Rainfall depth         33.312     33.312     33.312     mm"
"             Rainfall volume        87.94      58.63      146.57     c.m"
"             Rainfall losses        24.711     5.573      17.056     mm"
"             Runoff depth           8.601      27.739     16.256     mm"
"             Runoff volume          22.71      48.82      71.53      c.m"
"             Maximum flow           0.005      0.036      0.036      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"              Maximum flow                    0.001    c.m/sec"
"              Hydrograph volume              71.968    c.m"
"                    0.047     0.047     0.001     0.001"
" 40           HYDROGRAPH Start - New Tributary"
"              2   Start - New Tributary"
"                    0.047     0.000     0.001     0.001"
================================================================
                          CATCHMENT 46
================================================================
" 33           CATCHMENT 46"
"              1   Triangular SCS"
"              1   Equal length"
"              1   SCS method"
"             46   ID number"
"         50.000   % Impervious"
"          0.110   Total Area"
"          5.750   Flow length"
"          2.000   Overland Slope"
"          0.055   Pervious Area"
"          5.750   Pervious length"
"          2.000   Pervious slope"
"          0.055   Impervious Area"
"          5.750   Impervious length"
"          2.000   Impervious slope"
"          0.250   Pervious Manning 'n'"
"         81.000   Pervious SCS Curve No."
"          0.258   Pervious Runoff coefficient"
"          0.100   Pervious Ia/S coefficient"
"          5.958   Pervious Initial abstraction"
"          0.015   Impervious Manning 'n'"
"         98.000   Impervious SCS Curve No."
"          0.850   Impervious Runoff coefficient"
"          0.100   Impervious Ia/S coefficient"
"          0.518   Impervious Initial abstraction"
"                    0.012     0.000     0.001     0.001 c.m/sec"
"               Catchment 46          Pervious   Impervious Total Area "
"               Surface Area          0.055      0.055      0.110      hectare"
"               Time of concentration 8.860      0.847      2.779      minutes"
"               Time to Centroid      105.679    83.592     88.917     minutes"
"               Rainfall depth        33.312     33.312     33.312     mm"
"               Rainfall volume       18.32      18.32      36.64      c.m"
"               Rainfall losses       24.731     6.304      15.518     mm"
"               Runoff depth          8.581      27.008     17.794     mm"
"               Runoff volume         4.72       14.85      19.57      c.m"
"               Maximum flow          0.002      0.012      0.012      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"              4   Add Runoff "
"                    0.012     0.012     0.001     0.001"
" 52           CHANNEL DESIGN"
"          0.012   Current peak flow    c.m/sec"
"          0.035   Manning 'n'"
"             0.   Cross-section type: 0=trapezoidal; 1=general"
"          1.500   Basewidth    metre"
"          2.000   Left bank slope"
"          2.000   Right bank slope"
"          0.900   Channel depth    metre"
"          0.500   Gradient   %"
"               Depth of flow                 0.037    metre"
"               Velocity                      0.215    m/sec"
"               Channel capacity              3.967    c.m/sec"
"               Critical depth                0.019    metre"
" 53           ROUTE 47"
"          47.00   Reach length( metre)"
"          0.454   X-factor <= 0.5"
"        164.182   K-lag   ( seconds)"
"          0.000   Default(0) or user spec.(1) values used"
"          0.500   X-factor <= 0.5"
"         30.000   K-lag   ( seconds)"
"          0.500   Beta weighting factor"
"        150.000   Routing time step   ( seconds)"
"              1   No. of sub-reaches"
"               Peak outflow                  0.011    c.m/sec"
"                    0.012     0.012     0.011     0.001 c.m/sec"
" 40           HYDROGRAPH   Combine    20"
"              6   Combine "
"             20   Node #"
"                  "
"               Maximum flow                  0.012    c.m/sec"
"               Hydrograph volume            91.542    c.m"
"                    0.012     0.012     0.011     0.012"
" 40           HYDROGRAPH   Confluence    20"
"              7   Confluence "
"             20   Node #"
"                  "
"               Maximum flow                  0.012    c.m/sec"
"               Hydrograph volume            91.542    c.m"
"                    0.012     0.012     0.011     0.000"
" 52           CHANNEL DESIGN"
"          0.012   Current peak flow    c.m/sec"
"          0.035   Manning 'n'"
"             0.   Cross-section type: 0=trapezoidal; 1=general"
"          1.500   Basewidth    metre"
"          2.000   Left bank slope"
"          2.000   Right bank slope"
"          0.900   Channel depth    metre"
"          0.500   Gradient   %"
"               Depth of flow                 0.036    metre"
"               Velocity                      0.212    m/sec"
"               Channel capacity              3.967    c.m/sec"
"               Critical depth                0.018    metre"
" 53           ROUTE 35"
"          35.00   Reach length( metre)"
```

Midus98 — Steve Brown - AGM Engineering Ltd. — Tuesday, June 08,2004,11:20 AM

File Options Hydrology Hydrograph Design Show Automatic Tools Window Help

ROUTE

Last conduit

Type Channel - simple

Channel depth: 0.900 metre

Gradient 0.500 %

Manning 'n' 0.035

Depth of flow 0.152 metre

Flow capacity 3.967 c.m/sec

Peak Inflow 0.139 c.m/sec

Reach length 10 metre

X factor x = 0.5 0.000

K lag 14.8 seconds

Peak Outflow 0.138 c.m/sec

Specify values for X and K

Route Cancel

UnDo Accept

Using 1 reaches of length 10.0 metre

Using 8 timesteps of duration 37.5 seconds

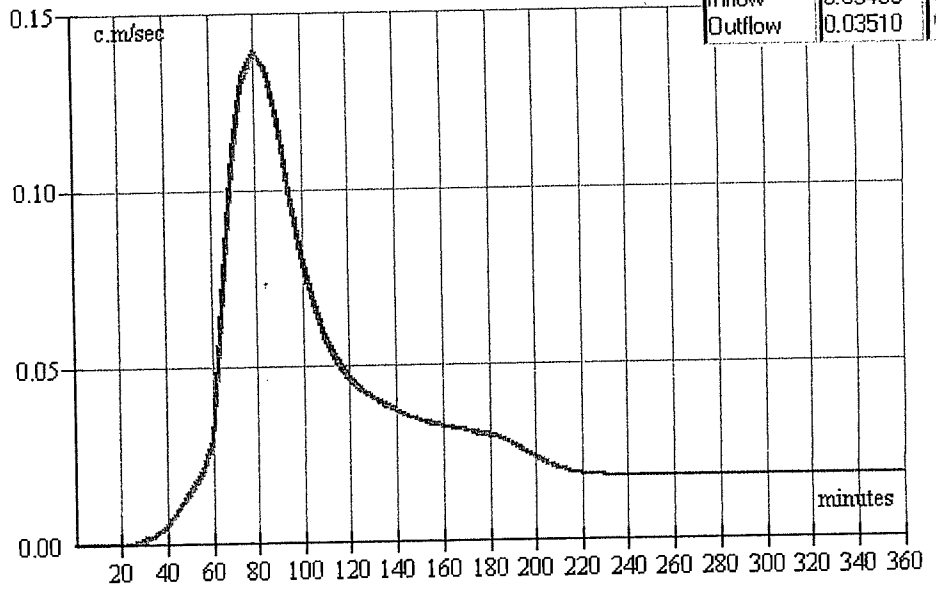
Outflow Hydrograph

Total volume 1514.07 c.m Maximum flow 0.138 c.m/sec 0.0 minutes

	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.005	0.010	0.014
0	0.019	0.028	0.064	0.107	0.130	0.138	0.135	0.119	0.099	0.081
5.0	0.067	0.058	0.051	0.047	0.043	0.041	0.039	0.037	0.036	0.035
0.0	0.034	0.033	0.032	0.031	0.031	0.030	0.029	0.027	0.026	0.024
5.0	0.022	0.021	0.020	0.019	0.019	0.019	0.018	0.018	0.018	0.018
0.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
5.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
0.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
5.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
0.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.017
5.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
0.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
5.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
0.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
5.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
0.0	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
5.0	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
0.0	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
5.0	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016

Inflow & Outflow hydrograph

minutes	148
Inflow	0.03498
Outflow	0.03510



Plot duration 360 minutes

Input 2yrpost Out Automatic Output 2yrpost1 Out

Has options to define input and output files and control screen printing

Start Midus98 Graphics Server 11:20 AM

APPENDIX E

MIDUSS OUTPUT

100 YEAR STORM – POST DEVELOPMENT

```
"                MIDUSS 98 Output---------------------------------------------->"
"                MIDUSS 98 version number                                  1.00"
"                MIDUSS 98 created                              October 10, 2001"
"           10   Units used:                                            ie METRIC"
"                Project filename:                  G:\CLIENT\1133\1\MIDUSS\"
"                Output filename:                                  100yrpst8.Out"
"                Licensee name:                                      Steve Brown"
"                Company                                   AGM Engineering Ltd."
"                Date & Time last used:                    08/06/04 at 9:38:43 AM"
" 31          TIME PARAMETERS"
"       5.000   Time Step"
"     180.000   Max. Storm length"
"    1200.000   Max. Hydrograph"
================================================================
                                100 YEAR STORM
================================================================
" 32          STORM Chicago storm"
"           1   Chicago storm"
"    1499.530   Coefficient A"
"       3.297   Constant B"
"       0.794   Exponent C"
"       0.350   Fraction R"
"     180.000   Duration"
"       1.000   Time step multiplier"
"            Maximum intensity          264.015    mm/hr"
"            Total depth                 71.801    mm"
"           6   100hyd   Hydrograph extension used in this file"
================================================================
                                CATCHMENT 1
================================================================
" 33          CATCHMENT 1"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"           1   ID number"
"      50.000   % Impervious"
"       0.090   Total Area"
"       5.750   Flow length"
"       2.000   Overland Slope"
"       0.045   Pervious Area"
"       5.750   Pervious length"
"       2.000   Pervious slope"
"       0.045   Impervious Area"
"       5.750   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      81.000   Pervious SCS Curve No."
"       0.481   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       5.958   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.925   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                    0.033     0.000     0.000     0.000 c.m/sec"
"            Catchment 1          Pervious   Impervious Total Area "
"            Surface Area         0.045      0.045      0.090      hectare"
"            Time of concentration 4.259     0.566      1.893      minutes"
"            Time to Centroid     94.699     81.236     86.073     minutes"
"            Rainfall depth       71.801     71.801     71.801     mm"
"            Rainfall volume      32.31      32.31      64.62      c.m"
"            Rainfall losses      37.589     10.785     24.187     mm"
"            Runoff depth         34.212     61.017     47.614     mm"
"            Runoff volume        15.40      27.46      42.85      c.m"
"            Maximum flow         0.011      0.027      0.033      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                    0.033     0.033     0.000     0.000"
" 51          PIPE DESIGN"
"       0.033   Current peak flow    c.m/sec"
"       0.013   Manning 'n'"
"       0.300   Diameter    metre"
"       0.500   Gradient   %"
"            Depth of flow                0.147    metre"
"            Velocity                     0.958    m/sec"
"            Pipe capacity                0.068    c.m/sec"
"            Critical depth               0.139    metre"
" 53          ROUTE 10"
"      10.00   Reach length( metre)"
"       0.000   X-factor <= 0.5"
"       7.830   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.639   Beta weighting factor"
"      20.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                 0.032    c.m/sec"
"                    0.033     0.033     0.032     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"           5   Next link "
"                    0.033     0.032     0.032     0.000"
" 52          CHANNEL DESIGN"
"       0.032   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"         0.    Cross-section type: 0=trapezoidal; 1=general"
"       1.500   Basewidth    metre"
"       2.000   Left bank slope"
"       2.000   Right bank slope"
"       0.900   Channel depth    metre"
"       0.500   Gradient   %"
```

```
"              Maximum flow                  0.062    c.m/sec"
"              Hydrograph volume           212.513    c.m"
"                      0.091     0.062      0.050     0.000"
=================================================================
                            CATCHMENT 3
=================================================================
" 33          CATCHMENT 3"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            3   ID number"
"       50.000   % Impervious"
"        0.070   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.035   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.035   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                      0.026     0.062     0.050     0.000 c.m/sec"
"             Catchment 3            Pervious   Impervious Total Area "
"             Surface Area           0.035      0.035      0.070      hectare"
"             Time of concentration  4.259      0.566      1.893      minutes"
"             Time to Centroid       94.699     81.236     86.073     minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        25.13      25.13      50.26      c.m"
"             Rainfall losses        37.589     10.785     24.187     mm"
"             Runoff depth           34.212     61.017     47.614     mm"
"             Runoff volume          11.97      21.36      33.33      c.m"
"             Maximum flow           0.008      0.021      0.026      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.026     0.069     0.050     0.000"
" 51          PIPE DESIGN"
"        0.069   Current peak flow    c.m/sec"
"        0.014   Manning 'n'"
"        0.400   Diameter    metre"
"        0.500   Gradient    %"
"             Depth of flow                 0.201    metre"
"             Velocity                      1.090    m/sec"
"             Pipe capacity                 0.137    c.m/sec"
"             Critical depth                0.187    metre"
" 53          ROUTE 10"
"       10.00   Reach length( metre)"
"       0.000   X-factor <= 0.5"
"       6.880   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.704   Beta weighting factor"
"      23.077   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                      0.068    c.m/sec"
"                    0.026     0.069     0.068     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.026     0.068     0.068     0.000"
" 52          CHANNEL DESIGN"
"        0.068   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient    %"
"             Depth of flow                 0.100    metre"
"             Velocity                      0.398    m/sec"
"             Channel capacity              3.967    c.m/sec"
"             Critical depth                0.058    metre"
" 53          ROUTE 50"
"       50.20   Reach length( metre)"
"       0.383   X-factor <= 0.5"
"      94.506   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     100.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                      0.060    c.m/sec"
"                    0.026     0.068     0.060     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    2"
"            6   Combine "
"            2   Node #"
"                "
"             Maximum flow                  0.060    c.m/sec"
"             Hydrograph volume           245.751    c.m"
"                    0.026     0.068     0.060     0.060"
" 40          HYDROGRAPH Start - New Tributary"
```

```
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.022     0.106     0.050     0.000 c.m/sec"
"             Catchment 5             Pervious   Impervious Total Area "
"             Surface Area            0.030      0.030      0.060      hectare"
"             Time of concentration   4.259      0.566      1.893      minutes"
"             Time to Centroid        94.699     81.236     86.073     minutes"
"             Rainfall depth          71.801     71.801     71.801     mm"
"             Rainfall volume         21.54      21.54      43.08      c.m"
"             Rainfall losses         37.589     10.785     24.187     mm"
"             Runoff depth            34.212     61.017     47.614     mm"
"             Runoff volume           10.26      18.30      28.57      c.m"
"             Maximum flow            0.007      0.018      0.022      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.022     0.112     0.050     0.000"
" 51          PIPE DESIGN"
"        0.112   Current peak flow    c.m/sec"
"        0.014   Manning 'n'"
"        0.400   Diameter    metre"
"        0.500   Gradient   %"
"             Depth of flow                  0.276    metre"
"             Velocity                       1.215    m/sec"
"             Pipe capacity                  0.137    c.m/sec"
"             Critical depth                 0.242    metre"
" 53          ROUTE 10"
"       10.00   Reach length( metre)"
"        0.000   X-factor <= 0.5"
"        6.174   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.829   Beta weighting factor"
"       30.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.111    c.m/sec"
"                  0.022     0.112     0.111     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.022     0.111     0.111     0.000"
" 52          CHANNEL DESIGN"
"        0.111   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                  0.133    metre"
"             Velocity                       0.471    m/sec"
"             Channel capacity               3.967    c.m/sec"
"             Critical depth                 0.079    metre"
" 53          ROUTE 50"
"       50.20   Reach length( metre)"
"        0.346   X-factor <= 0.5"
"       79.978   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.108    c.m/sec"
"                  0.022     0.111     0.108     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    3"
"            6   Combine "
"            3   Node #"
"                "
"             Maximum flow                  0.108    c.m/sec"
"             Hydrograph volume           443.824    c.m"
"                  0.022     0.111     0.108     0.108"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.022     0.000     0.108     0.108"
================================================================
                          CATCHMENT 6
================================================================
" 33          CATCHMENT 6"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            6   ID number"
"       40.000   % Impervious"
"        0.400   Total Area"
"       60.200   Flow length"
"        2.000   Overland Slope"
"        0.240   Pervious Area"
"       60.200   Pervious length"
"        2.000   Pervious slope"
"        0.160   Impervious Area"
"       60.200   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
```

```
"        0.450   Diameter    metre"
"        0.500   Gradient    %"
"             Depth of flow                  0.331    metre"
"             Velocity                       1.242    m/sec"
"             Pipe capacity                  0.175    c.m/sec"
"             Critical depth                 0.277    metre"
" 53          ROUTE 10"
"       10.00   Reach length( metre)"
"        0.000   X-factor <= 0.5"
"        6.040   K-lag    ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag    ( seconds)"
"        0.859   Beta weighting factor"
"       37.500   Routing time step    ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.156    c.m/sec"
"                    0.026     0.156     0.156     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                    0.026     0.156     0.156     0.000"
" 52          CHANNEL DESIGN"
"        0.156   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.650   Gradient    %"
"             Depth of flow                  0.150    metre"
"             Velocity                       0.575    m/sec"
"             Channel capacity               4.523    c.m/sec"
"             Critical depth                 0.099    metre"
" 53          ROUTE 50"
"       50.20   Reach length( metre)"
"        0.367   X-factor <= 0.5"
"       65.499   K-lag    ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag    ( seconds)"
"        0.500   Beta weighting factor"
"       75.000   Routing time step    ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.154    c.m/sec"
"                    0.026     0.156     0.154     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    4"
"            6   Combine "
"            4   Node #"
"                "
"             Maximum flow                   0.154    c.m/sec"
"             Hydrograph volume            646.620    c.m"
"                    0.026     0.156     0.154     0.154"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.026     0.000     0.154     0.154"
================================================================
                          CATCHMENT 8
================================================================
" 33          CATCHMENT 8"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"            8   ID number"
"       50.000   % Impervious"
"        0.120   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.060   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.060   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.044     0.000     0.154     0.154 c.m/sec"
"             Catchment 8            Pervious   Impervious Total Area "
"             Surface Area           0.060      0.060      0.120      hectare"
"             Time of concentration  4.259      0.566      1.893      minutes"
"             Time to Centroid       94.699     81.236     86.073     minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        43.08      43.08      86.16      c.m"
"             Rainfall losses        37.589     10.785     24.187     mm"
"             Runoff depth           34.212     61.017     47.614     mm"
"             Runoff volume          20.53      36.61      57.14      c.m"
"             Maximum flow           0.014      0.036      0.044      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.044     0.044     0.154     0.154"
" 52          CHANNEL DESIGN"
"        0.044   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
```

```
"            Catchment 10            Pervious   Impervious Total Area "
"            Surface Area            0.360      0.240      0.600      hectare"
"            Time of concentration   22.154     2.945      11.433     minutes"
"            Time to Centroid        119.484    84.305     99.851     minutes"
"            Rainfall depth          71.801     71.801     71.801     mm"
"            Rainfall volume         258.48     172.32     430.81     c.m"
"            Rainfall losses         37.290     6.426      24.945     mm"
"            Runoff depth            34.511     65.375     46.857     mm"
"            Runoff volume           124.24     156.90     281.14     c.m"
"            Maximum flow            0.039      0.120      0.135      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.135     0.226     0.038     0.165"
" 54         POND DESIGN"
"       0.226   Current peak flow    c.m/sec"
"       470.0   Hydrograph volume    c.m/sec"
"          6.   Number of stages"
"       0.000   Minimum water level    c.m/sec"
"       0.750   Maximum water level    c.m/sec"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                 0.000     0.000       0.0"
"                 0.300     0.001       0.1"
"                 0.450     0.001      12.0"
"                 0.600     0.001      85.6"
"                 0.740     0.001     144.0"
"                 0.750     0.162     150.0"
"          1.   ORIFICES"
"               Orifice   Orifice   Orifice Number of"
"                invert coefficie  diameter  orifices"
"                 0.000     0.600     0.025     1.000"
"            Peak outflow                  0.150    c.m/sec"
"            Maximum level                 0.749    metre"
"            Maximum storage             149.562    c.m"
"            Centroidal lag                6.432   hours"
"                 0.135     0.226     0.150     0.165 c.m/sec"
" 40         HYDROGRAPH   Combine    4"
"           6   Combine "
"           4   Node #"
"               "
"            Maximum flow                  0.268    c.m/sec"
"            Hydrograph volume          1088.806    c.m"
"                   0.135     0.226     0.150     0.268"
" 40         HYDROGRAPH   Confluence    4"
"           7   Confluence "
"           4   Node #"
"               "
"            Maximum flow                  0.268    c.m/sec"
"            Hydrograph volume          1088.806    c.m"
"                   0.135     0.268     0.150     0.000"
" 54         POND DESIGN"
"       0.268   Current peak flow    c.m/sec"
"      1090.0   Hydrograph volume    c.m/sec"
"          6.   Number of stages"
"       0.000   Minimum water level    c.m/sec"
"       1.000   Maximum water level    c.m/sec"
"           0   Keep Design Data: 1 = True; 0 = False"
"                 Level Discharge    Volume"
"                 0.000     0.000       0.0"
"                 0.200     0.021       6.8"
"                 0.400     0.086      29.4"
"                 0.600     0.122      80.8"
"                 0.800     0.150     146.1"
"                 1.000     0.173     231.4"
"          1.   ORIFICES"
"               Orifice   Orifice   Orifice Number of"
"                invert coefficie  diameter  orifices"
"                 0.000     0.600     0.305     1.000"
"            Peak outflow                  0.160    c.m/sec"
"            Maximum level                 0.883    metre"
"            Maximum storage             181.542    c.m"
"            Centroidal lag                4.172   hours"
"                 0.135     0.268     0.160     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                 0.135     0.160     0.160     0.000"
================================================================
                          ROAD CULVERT
================================================================
" 51         PIPE DESIGN"
"       0.160   Current peak flow    c.m/sec"
"       0.015   Manning 'n'"
"       0.450   Diameter    metre"
"       0.420   Gradient    %"
"            Depth of flow                 0.395    metre"
"            Velocity                      1.187    m/sec"
"            Pipe capacity                 0.160    c.m/sec"
"            Critical depth                0.281    metre"
" 53         ROUTE 18"
"       18.00   Reach length( metre)"
"       0.000   X-factor <= 0.5"
"      11.373   K-lag    ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag    ( seconds)"
"       0.834   Beta weighting factor"
"      50.000   Routing time step    ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.160    c.m/sec"
"                 0.135     0.160     0.160     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    5"
"           6   Combine "
```

```
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.035   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.026     0.165     0.038     0.000 c.m/sec"
"             Catchment 12           Pervious   Impervious Total Area "
"             Surface Area           0.035      0.035      0.070      hectare"
"             Time of concentration  4.259      0.566      1.893      minutes"
"             Time to Centroid       94.699     81.236     86.073     minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        25.13      25.13      50.26      c.m"
"             Rainfall losses        37.589     10.785     24.187     mm"
"             Runoff depth           34.212     61.017     47.614     mm"
"             Runoff volume          11.97      21.36      33.33      c.m"
"             Maximum flow           0.008      0.021      0.025      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.026     0.168     0.038     0.000"
" 51          PIPE DESIGN"
"        0.168   Current peak flow    c.m/sec"
"        0.015   Manning 'n'"
"        0.500   Diameter    metre"
"        0.420   Gradient   %"
"             Depth of flow                 0.336    metre"
"             Velocity                      1.198    m/sec"
"             Pipe capacity                 0.212    c.m/sec"
"             Critical depth                0.279    metre"
" 53          ROUTE 10"
"       10.00   Reach length( metre)"
"        0.000   X-factor <= 0.5"
"        6.262   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.856   Beta weighting factor"
"       42.857   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.168    c.m/sec"
"                   0.026     0.168     0.168     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.026     0.168     0.168     0.000"
" 52          CHANNEL DESIGN"
"        0.168   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.420   Gradient   %"
"             Depth of flow                 0.178    metre"
"             Velocity                      0.508    m/sec"
"             Channel capacity              3.636    c.m/sec"
"             Critical depth                0.103    metre"
" 53          ROUTE 46"
"       46.10   Reach length( metre)"
"        0.238   X-factor <= 0.5"
"       68.015   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                  0.168    c.m/sec"
"                   0.026     0.168     0.168     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    6"
"            6   Combine "
"            6   Node #"
"                "
"             Maximum flow                  0.168    c.m/sec"
"             Hydrograph volume          1177.083    c.m"
"                   0.026     0.168     0.168     0.168"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.026     0.000     0.168     0.168"
================================================================
                              CATCHMENT 13
================================================================
" 33          CATCHMENT 13"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           13   ID number"
"       40.000   % Impervious"
"        0.440   Total Area"
"       56.100   Flow length"
"        2.000   Overland Slope"
"        0.264   Pervious Area"
"       56.100   Pervious length"
```

```
"            Runoff volume          10.26       18.30       28.57       c.m"
"            Maximum flow           0.007       0.018       0.022       c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.022     0.211     0.068     0.000"
" 51         PIPE DESIGN"
"       0.211   Current peak flow    c.m/sec"
"       0.015   Manning 'n'"
"       0.500   Diameter    metre"
"       0.420   Gradient    %"
"            Depth of flow                 0.408    metre"
"            Velocity                      1.231    m/sec"
"            Pipe capacity                 0.212    c.m/sec"
"            Critical depth                0.314    metre"
" 53         ROUTE 10"
"      10.00    Reach length( metre)"
"       0.000   X-factor <= 0.5"
"       6.091   K-lag    ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag    ( seconds)"
"       0.909   Beta weighting factor"
"      60.000   Routing time step    ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.210    c.m/sec"
"                 0.022     0.211     0.210     0.000 c.m/sec"
" 40         HYDROGRAPH Next link "
"           5   Next link "
"                 0.022     0.210     0.210     0.000"
" 52         CHANNEL DESIGN"
"       0.210   Current peak flow    c.m/sec"
"       0.035   Manning 'n'"
"          0.   Cross-section type: 0=trapezoidal; 1=general"
"       1.500   Basewidth    metre"
"       2.000   Left bank slope"
"       2.000   Right bank slope"
"       0.900   Channel depth    metre"
"       0.420   Gradient    %"
"            Depth of flow                 0.202    metre"
"            Velocity                      0.545    m/sec"
"            Channel capacity              3.636    c.m/sec"
"            Critical depth                0.119    metre"
" 53         ROUTE 46"
"      46.10    Reach length( metre)"
"       0.206   X-factor <= 0.5"
"      63.388   K-lag    ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag    ( seconds)"
"       0.500   Beta weighting factor"
"     100.000   Routing time step    ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                  0.208    c.m/sec"
"                 0.022     0.210     0.208     0.000 c.m/sec"
" 40         HYDROGRAPH   Combine    7"
"           6   Combine "
"           7   Node #"
"               "
"            Maximum flow                  0.208    c.m/sec"
"            Hydrograph volume          1404.083    c.m"
"                 0.022     0.210     0.208     0.208"
" 40         HYDROGRAPH Start - New Tributary"
"           2   Start - New Tributary"
"                 0.022     0.000     0.208     0.208"
=================================================================
                              CATCHMENT 15
=================================================================
" 33          CATCHMENT 15"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          15   ID number"
"      40.000   % Impervious"
"       0.460   Total Area"
"      56.100   Flow length"
"       2.000   Overland Slope"
"       0.276   Pervious Area"
"      56.100   Pervious length"
"       2.000   Pervious slope"
"       0.184   Impervious Area"
"      56.100   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      81.000   Pervious SCS Curve No."
"       0.481   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       5.958   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.925   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                 0.104     0.000     0.208     0.208 c.m/sec"
"            Catchment 15          Pervious   Impervious Total Area "
"            Surface Area          0.276      0.184      0.460      hectare"
"            Time of concentration 16.705     2.221      8.601      minutes"
"            Time to Centroid      111.906    83.063     95.769     minutes"
"            Rainfall depth        71.801     71.801     71.801     mm"
"            Rainfall volume       198.17     132.11     330.29     c.m"
"            Rainfall losses       37.298     6.069      24.807     mm"
"            Runoff depth          34.503     65.732     46.994     mm"
"            Runoff volume         95.23      120.95     216.17     c.m"
```

```
"             Peak outflow                    0.322    c.m/sec"
"                  0.022     0.323     0.322     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.022     0.322     0.322     0.000"
" 52          CHANNEL DESIGN"
"        0.322   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.580   Gradient   %"
"             Depth of flow                  0.235    metre"
"             Velocity                       0.697    m/sec"
"             Channel capacity               4.273    c.m/sec"
"             Critical depth                 0.156    metre"
" 53          ROUTE 46"
"       46.10   Reach length( metre)"
"        0.255   X-factor <= 0.5"
"       49.596   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"       60.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.321    c.m/sec"
"                  0.022     0.322     0.321     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    9"
"            6   Combine "
"            9   Node #"
"                "
"             Maximum flow                   0.321    c.m/sec"
"             Hydrograph volume           1871.106    c.m"
"                  0.022     0.322     0.321     0.321"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.022     0.000     0.321     0.321"
================================================================
                          CATCHMENT 19
================================================================
" 33          CATCHMENT 19"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           19   ID number"
"       40.000   % Impervious"
"        0.460   Total Area"
"       56.100   Flow length"
"        2.000   Overland Slope"
"        0.276   Pervious Area"
"       56.100   Pervious length"
"        2.000   Pervious slope"
"        0.184   Impervious Area"
"       56.100   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.104     0.000     0.321     0.321 c.m/sec"
"             Catchment 19          Pervious   Impervious Total Area "
"             Surface Area          0.276      0.184      0.460      hectare"
"             Time of concentration 16.705     2.221      8.601      minutes"
"             Time to Centroid      111.906    83.063     95.769     minutes"
"             Rainfall depth        71.801     71.801     71.801     mm"
"             Rainfall volume       198.17     132.11     330.29     c.m"
"             Rainfall losses       37.298     6.069      24.807     mm"
"             Runoff depth          34.503     65.732     46.994     mm"
"             Runoff volume         95.23      120.95     216.17     c.m"
"             Maximum flow          0.036      0.092      0.104      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.104     0.104     0.321     0.321"
" 54          POND DESIGN"
"        0.104   Current peak flow    c.m/sec"
"        220.0   Hydrograph volume    c.m/sec"
"           6.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000      0.0"
"                  0.300     0.001      0.1"
"                  0.450     0.001      4.7"
"                  0.600     0.001     37.1"
"                  0.740     0.001     72.0"
"                  0.750     0.076     75.0"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                  0.000     0.600     0.025     1.000"
"              Peak outflow                   0.076    c.m/sec"
"              Maximum level                  0.750    metre"
```

```
"       30.000   K-lag    ( seconds)"
"        0.500   Beta weighting factor"
"       42.857   Routing time step    ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                    0.373    c.m/sec"
"                   0.022     0.374     0.373     0.000 c.m/sec"
"
" 40          HYDROGRAPH   Combine    10"
"            6   Combine "
"           10   Node #"
"                "
"             Maximum flow                    0.373    c.m/sec"
"             Hydrograph volume            2105.548    c.m"
"                   0.022     0.374     0.373     0.373"
"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                   0.022     0.000     0.373     0.373"
"
==================================================================
                                CATCHMENT 21
==================================================================
" 33          CATCHMENT 21"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           21   ID number"
"       40.000   % Impervious"
"        0.460   Total Area"
"       56.100   Flow length"
"        2.000   Overland Slope"
"        0.276   Pervious Area"
"       56.100   Pervious length"
"        2.000   Pervious slope"
"        0.184   Impervious Area"
"       56.100   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                   0.104     0.000     0.373     0.373 c.m/sec"
"
"                Catchment 21          Pervious   Impervious Total Area "
"                Surface Area          0.276      0.184      0.460      hectare"
"                Time of concentration 16.705     2.221      8.601      minutes"
"                Time to Centroid      111.906    83.063     95.769     minutes"
"                Rainfall depth        71.801     71.801     71.801     mm"
"                Rainfall volume       198.17     132.11     330.29     c.m"
"                Rainfall losses       37.298     6.069      24.807     mm"
"                Runoff depth          34.503     65.732     46.994     mm"
"                Runoff volume         95.23      120.95     216.17     c.m"
"                Maximum flow          0.036      0.092      0.104      c.m/sec"
"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                   0.104     0.104     0.373     0.373"
"
" 54          POND DESIGN"
"        0.104   Current peak flow    c.m/sec"
"        220.0   Hydrograph volume    c.m/sec"
"           6.   Number of stages"
"        0.000   Minimum water level    c.m/sec"
"        0.750   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000      0.0"
"                  0.300     0.001      0.1"
"                  0.450     0.001      4.7"
"                  0.600     0.001     37.1"
"                  0.740     0.001     72.0"
"                  0.750     0.076     75.0"
"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                  0.000     0.600     0.025     1.000"
"                Peak outflow                    0.076    c.m/sec"
"                Maximum level                   0.750    metre"
"                Maximum storage                74.987    c.m"
"                Centroidal lag                  5.342    hours"
"                   0.104     0.104     0.076     0.373 c.m/sec"
"
" 40          HYDROGRAPH   Combine    10"
"            6   Combine "
"           10   Node #"
"                "
"             Maximum flow                    0.421    c.m/sec"
"             Hydrograph volume            2311.736    c.m"
"                   0.104     0.104     0.076     0.421"
"
" 40          HYDROGRAPH   Confluence    10"
"            7   Confluence "
"           10   Node #"
"                "
"             Maximum flow                    0.421    c.m/sec"
"             Hydrograph volume            2311.736    c.m"
"                   0.104     0.421     0.076     0.000"
"
" 51          PIPE DESIGN"
"        0.421   Current peak flow    c.m/sec"
"        0.016   Manning 'n'"
"        0.600   Diameter    metre"
"        1.000   Gradient    %"
"                Depth of flow                   0.423    metre"
"                Velocity                        1.978    m/sec"
```

CATCHMENT 25
EXISTING LOT

```
" 33          CATCHMENT 25"
"              1   Triangular SCS"
"              1   Equal length"
"              1   SCS method"
"             25   ID number"
"         40.000   % Impervious"
"          0.470   Total Area"
"         73.000   Flow length"
"          2.000   Overland Slope"
"          0.282   Pervious Area"
"         73.000   Pervious length"
"          2.000   Pervious slope"
"          0.188   Impervious Area"
"         73.000   Impervious length"
"          2.000   Impervious slope"
"          0.250   Pervious Manning 'n'"
"         81.000   Pervious SCS Curve No."
"          0.481   Pervious Runoff coefficient"
"          0.100   Pervious Ia/S coefficient"
"          5.958   Pervious Initial abstraction"
"          0.015   Impervious Manning 'n'"
"         98.000   Impervious SCS Curve No."
"          0.925   Impervious Runoff coefficient"
"          0.100   Impervious Ia/S coefficient"
"          0.518   Impervious Initial abstraction"
"                      0.106     0.000     0.031     0.031 c.m/sec"
"                Catchment 25            Pervious   Impervious Total Area "
"                Surface Area            0.282      0.188      0.470      hectare"
"                Time of concentration   19.565     2.601      10.094     minutes"
"                Time to Centroid        115.891    83.742     97.943     minutes"
"                Rainfall depth          71.801     71.801     71.801     mm"
"                Rainfall volume         202.48     134.99     337.47     c.m"
"                Rainfall losses         37.290     6.373      24.923     mm"
"                Runoff depth            34.511     65.428     46.878     mm"
"                Runoff volume           97.32      123.01     220.33     c.m"
"                Maximum flow            0.032      0.091      0.106      c.m/sec"
"
" 40             HYDROGRAPH Add Runoff "
"               4   Add Runoff "
"                       0.106     0.106     0.031     0.031"
"
" 54              POND DESIGN"
"           0.106   Current peak flow    c.m/sec"
"           230.0   Hydrograph volume    c.m/sec"
"              5.   Number of stages"
"           0.000   Minimum water level    c.m/sec"
"           0.750   Maximum water level    c.m/sec"
"               0   Keep Design Data: 1 = True; 0 = False"
"                     Level Discharge    Volume"
"                     0.000     0.000      0.0"
"                     0.188     0.001      1.0"
"                     0.375     0.001      4.0"
"                     0.563     0.001      30.0"
"                     0.750     0.050      75.0"
"                   Peak outflow                    0.048    c.m/sec"
"                   Maximum level                   0.741    metre"
"                   Maximum storage                 72.736   c.m"
"                   Centroidal lag                  2.883    hours"
"                       0.106     0.106     0.048     0.031 c.m/sec"
" 40              HYDROGRAPH   Combine    12"
"                6   Combine "
"               12   Node #"
"                    "
"                   Maximum flow                    0.062    c.m/sec"
"                   Hydrograph volume               267.802  c.m"
"                       0.106     0.106     0.048     0.062"
"
" 40              HYDROGRAPH Start - New Tributary"
"                2   Start - New Tributary"
"                       0.106     0.000     0.048     0.062"
"
```

CATCHMENT 26

```
" 33          CATCHMENT 26"
"              1   Triangular SCS"
"              1   Equal length"
"              1   SCS method"
"             26   ID number"
"         50.000   % Impervious"
"          0.100   Total Area"
"          5.750   Flow length"
"          2.000   Overland Slope"
"          0.050   Pervious Area"
"          5.750   Pervious length"
"          2.000   Pervious slope"
"          0.050   Impervious Area"
"          5.750   Impervious length"
"          2.000   Impervious slope"
"          0.250   Pervious Manning 'n'"
"         81.000   Pervious SCS Curve No."
"          0.481   Pervious Runoff coefficient"
"          0.100   Pervious Ia/S coefficient"
"          5.958   Pervious Initial abstraction"
"          0.015   Impervious Manning 'n'"
"         98.000   Impervious SCS Curve No."
"          0.925   Impervious Runoff coefficient"
"          0.100   Impervious Ia/S coefficient"
"          0.518   Impervious Initial abstraction"
"                      0.037     0.000     0.048     0.062 c.m/sec"
"                Catchment 26            Pervious   Impervious Total Area "
"                Surface Area            0.050      0.050      0.100      hectare"
"                Time of concentration   4.259      0.566      1.893      minutes"
"
```

```
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.037     0.000     0.085     0.085 c.m/sec"
"             Catchment 27           Pervious   Impervious Total Area "
"             Surface Area           0.050      0.050      0.100      hectare"
"             Time of concentration  4.259      0.566      1.893      minutes"
"             Time to Centroid       94.699     81.236     86.073     minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        35.90      35.90      71.80      c.m"
"             Rainfall losses        37.589     10.785     24.187     mm"
"             Runoff depth           34.212     61.017     47.614     mm"
"             Runoff volume          17.11      30.51      47.61      c.m"
"             Maximum flow           0.012      0.030      0.037      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.037     0.037     0.085     0.085"
" 52          CHANNEL DESIGN"
"        0.037   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                0.070    metre"
"             Velocity                     0.320    m/sec"
"             Channel capacity             3.967    c.m/sec"
"             Critical depth               0.039    metre"
" 53          ROUTE 73"
"       73.00   Reach length( metre)"
"       0.444   X-factor <= 0.5"
"     171.111   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     150.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"             Peak outflow                 0.031    c.m/sec"
"                  0.037     0.037     0.031     0.085 c.m/sec"
" 40          HYDROGRAPH   Combine    13"
"            6   Combine "
"           13   Node #"
"                "
"             Maximum flow                 0.116    c.m/sec"
"             Hydrograph volume          363.032    c.m"
"                  0.037     0.037     0.031     0.116"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                  0.037     0.000     0.031     0.116"
"=============================================================
                              CATCHMENT 28
                              EXISTING LOT
=============================================================
" 33          CATCHMENT 28"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           28   ID number"
"       40.000   % Impervious"
"        0.380   Total Area"
"       73.000   Flow length"
"        2.000   Overland Slope"
"        0.228   Pervious Area"
"       73.000   Pervious length"
"        2.000   Pervious slope"
"        0.152   Impervious Area"
"       73.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.086     0.000     0.031     0.116 c.m/sec"
"             Catchment 28           Pervious   Impervious Total Area "
"             Surface Area           0.228      0.152      0.380      hectare"
"             Time of concentration  19.565     2.601      10.094     minutes"
"             Time to Centroid       115.891    83.742     97.943     minutes"
"             Rainfall depth         71.801     71.801     71.801     mm"
"             Rainfall volume        163.71     109.14     272.84     c.m"
"             Rainfall losses        37.290     6.373      24.923     mm"
"             Runoff depth           34.511     65.428     46.878     mm"
"             Runoff volume          78.69      99.45      178.14     c.m"
"             Maximum flow           0.026      0.074      0.086      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.086     0.086     0.031     0.116"
" 54          POND DESIGN"
"        0.086   Current peak flow    c.m/sec"
"        180.0   Hydrograph volume    c.m/sec"
"           5.   Number of stages"
```

```
"        0.000   Minimum water level    c.m/sec"
"        0.900   Maximum water level    c.m/sec"
"            0   Keep Design Data: 1 = True; 0 = False"
"                  Level Discharge    Volume"
"                  0.000     0.000       0.0"
"                  0.150     0.008       4.8"
"                  0.300     0.023      22.5"
"                  0.450     0.030      57.9"
"                  0.600     0.036     111.3"
"                  0.750     0.041     172.3"
"                  0.900     0.046     245.0"
"           1.   ORIFICES"
"                Orifice   Orifice   Orifice Number of"
"                 invert coefficie  diameter  orifices"
"                  0.000     0.600     0.157     1.000"
"              Peak outflow                    0.046    c.m/sec"
"              Maximum level                   0.896    metre"
"              Maximum storage               243.140    c.m"
"              Centroidal lag                  3.465    hours"
"                  0.062     0.169     0.046     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                    0.062     0.046     0.046     0.000"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                    0.062     0.046     0.046     0.000"
================================================================
                              CATCHMENT 30
================================================================
" 33          CATCHMENT 30"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            30   ID number"
"        50.000   % Impervious"
"         0.080   Total Area"
"         5.750   Flow length"
"         2.000   Overland Slope"
"         0.040   Pervious Area"
"         5.750   Pervious length"
"         2.000   Pervious slope"
"         0.040   Impervious Area"
"         5.750   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.925   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.029     0.046     0.046     0.000 c.m/sec"
"                Catchment 30          Pervious   Impervious Total Area "
"                Surface Area          0.040      0.040      0.080      hectare"
"                Time of concentration 4.259      0.566      1.893      minutes"
"                Time to Centroid      94.699     81.236     86.073     minutes"
"                Rainfall depth        71.801     71.801     71.801     mm"
"                Rainfall volume       28.72      28.72      57.44      c.m"
"                Rainfall losses       37.589     10.785     24.187     mm"
"                Runoff depth          34.212     61.017     47.614     mm"
"                Runoff volume         13.68      24.41      38.09      c.m"
"                Maximum flow          0.009      0.024      0.029      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.029     0.053     0.046     0.000"
" 51          PIPE DESIGN"
"         0.053   Current peak flow    c.m/sec"
"         0.013   Manning 'n'"
"         0.300   Diameter    metre"
"         0.300   Gradient   %"
"              Depth of flow                 0.244    metre"
"              Velocity                      0.854    m/sec"
"              Pipe capacity                 0.053    c.m/sec"
"              Critical depth                0.178    metre"
" 53          ROUTE 10"
"        10.00   Reach length( metre)"
"         0.000   X-factor <= 0.5"
"         8.780   K-lag   ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag   ( seconds)"
"         0.884   Beta weighting factor"
"        75.000   Routing time step   ( seconds)"
"             1   No. of sub-reaches"
"              Peak outflow                  0.051    c.m/sec"
"                    0.029     0.053     0.051     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                    0.029     0.051     0.051     0.000"
" 52          CHANNEL DESIGN"
"         0.051   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         1.500   Basewidth    metre"
"         2.000   Left bank slope"
"         2.000   Right bank slope"
"         0.900   Channel depth    metre"
"         0.500   Gradient   %"
"              Depth of flow                 0.085    metre"
```

```
"            Rainfall losses          37.254      6.084      24.786      mm"
"            Runoff depth             34.547      65.717     47.015      mm"
"            Runoff volume            91.20       115.66     206.87      c.m"
"            Maximum flow             0.033       0.087      0.100       c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
"                 0.100     0.119     0.051     0.051"
" 54         POND DESIGN"
"       0.119   Current peak flow    c.m/sec"
"       250.0   Hydrograph volume    c.m/sec"
"          6.   Number of stages"
"       0.000   Minimum water level    c.m/sec"
"       0.750   Maximum water level    c.m/sec"
"           0   Keep Design Data: 1 = True; 0 = False"
                  Level Discharge    Volume"
                  0.000     0.000      0.0"
                  0.300     0.001      0.1"
                  0.450     0.001      4.7"
                  0.600     0.001     37.1"
                  0.740     0.001     72.0"
                  0.750     0.096     75.0"
"          1.   ORIFICES"
               Orifice   Orifice   Orifice Number of"
                invert coefficie  diameter  orifices"
                 0.000     0.600     0.025     1.000"
             Peak outflow                    0.090    c.m/sec"
             Maximum level                   0.749    metre"
             Maximum storage                74.802    c.m"
             Centroidal lag                  5.228    hours"
                 0.100     0.119     0.090     0.051 c.m/sec"
" 40         HYDROGRAPH   Combine    14"
"           6   Combine "
"          14   Node #"
"               "
             Maximum flow                    0.138    c.m/sec"
             Hydrograph volume             888.737    c.m"
                   0.100     0.119     0.090     0.138"
" 40         HYDROGRAPH   Confluence    14"
"           7   Confluence "
"          14   Node #"
"               "
             Maximum flow                    0.138    c.m/sec"
             Hydrograph volume             888.737    c.m"
                   0.100     0.138     0.090     0.000"
"
==========================================================================
                                CATCHMENT 33
==========================================================================
" 33          CATCHMENT 33"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           33   ID number"
"       50.000   % Impervious"
"        0.070   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.035   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.035   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
                   0.026     0.138     0.090     0.000 c.m/sec"
             Catchment 33           Pervious   Impervious Total Area "
             Surface Area           0.035      0.035      0.070      hectare"
             Time of concentration  4.259      0.566      1.893      minutes"
             Time to Centroid       94.699     81.236     86.073     minutes"
             Rainfall depth         71.801     71.801     71.801     mm"
             Rainfall volume        25.13      25.13      50.26      c.m"
             Rainfall losses        37.589     10.785     24.187     mm"
             Runoff depth           34.212     61.017     47.614     mm"
             Runoff volume          11.97      21.36      33.33      c.m"
             Maximum flow           0.008      0.021      0.026      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"           4   Add Runoff "
                  0.026     0.149     0.090     0.000"
" 51         PIPE DESIGN"
"       0.149   Current peak flow    c.m/sec"
"       0.015   Manning 'n'"
"       0.450   Diameter    metre"
"       0.500   Gradient   %"
             Depth of flow                  0.319    metre"
             Velocity                       1.234    m/sec"
             Pipe capacity                  0.175    c.m/sec"
             Critical depth                 0.270    metre"
" 53         ROUTE 10"
"       10.00   Reach length( metre)"
"       0.000   X-factor <= 0.5"
"       6.080   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
```

```
"              Surface Area              0.264       0.176       0.440       hectare"
"              Time of concentration     17.393      2.312       8.961       minutes"
"              Time to Centroid          112.842     83.216      96.279      minutes"
"              Rainfall depth            71.801      71.801      71.801      mm"
"              Rainfall volume           189.55      126.37      315.92      c.m"
"              Rainfall losses           37.251      6.088       24.786      mm"
"              Runoff depth              34.550      65.713      47.015      mm"
"              Runoff volume             91.21       115.66      206.87      c.m"
"              Maximum flow              0.033       0.087       0.100       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                   0.100     0.119     0.139     0.139"
"
" 54           POND DESIGN"
"          0.119   Current peak flow    c.m/sec"
"          250.0   Hydrograph volume    c.m/sec"
"             6.   Number of stages"
"          0.000   Minimum water level    c.m/sec"
"          0.750   Maximum water level    c.m/sec"
"              0   Keep Design Data: 1 = True; 0 = False"
"                    Level Discharge    Volume"
"                    0.000     0.000      0.0"
"                    0.300     0.001      0.1"
"                    0.450     0.001      4.7"
"                    0.600     0.001     37.1"
"                    0.740     0.001     72.0"
"                    0.750     0.096     75.0"
"
"             1.   ORIFICES"
"                  Orifice   Orifice   Orifice Number of"
"                   invert coefficie  diameter  orifices"
"                    0.000     0.600     0.025     1.000"
"                Peak outflow                    0.090    c.m/sec"
"                Maximum level                   0.749    metre"
"                Maximum storage                74.799    c.m"
"                Centroidal lag                  5.225    hours"
"                   0.100     0.119     0.090     0.139 c.m/sec"
" 40            HYDROGRAPH   Combine    15"
"               6   Combine "
"              15   Node #"
"                   "
"                Maximum flow                    0.229    c.m/sec"
"                Hydrograph volume            1150.034    c.m"
"                   0.100     0.119     0.090     0.229"
"
" 40            HYDROGRAPH   Confluence    15"
"               7   Confluence "
"              15   Node #"
"                   "
"                Maximum flow                    0.229    c.m/sec"
"                Hydrograph volume            1150.034    c.m"
"                   0.100     0.229     0.090     0.000"
"
================================================================
                              CATCHMENT 36
================================================================
" 33            CATCHMENT 36"
"               1   Triangular SCS"
"               1   Equal length"
"               1   SCS method"
"              36   ID number"
"          50.000   % Impervious"
"           0.070   Total Area"
"           5.750   Flow length"
"           2.000   Overland Slope"
"           0.035   Pervious Area"
"           5.750   Pervious length"
"           2.000   Pervious slope"
"           0.035   Impervious Area"
"           5.750   Impervious length"
"           2.000   Impervious slope"
"           0.250   Pervious Manning 'n'"
"          81.000   Pervious SCS Curve No."
"           0.481   Pervious Runoff coefficient"
"           0.100   Pervious Ia/S coefficient"
"           5.958   Pervious Initial abstraction"
"           0.015   Impervious Manning 'n'"
"          98.000   Impervious SCS Curve No."
"           0.925   Impervious Runoff coefficient"
"           0.100   Impervious Ia/S coefficient"
"           0.518   Impervious Initial abstraction"
"                      0.026     0.229     0.090     0.000 c.m/sec"
"
"                Catchment 36              Pervious   Impervious Total Area "
"                Surface Area              0.035      0.035      0.070      hectare"
"                Time of concentration     4.259      0.566      1.893      minutes"
"                Time to Centroid          94.699     81.236     86.073     minutes"
"                Rainfall depth            71.801     71.801     71.801     mm"
"                Rainfall volume           25.13      25.13      50.26      c.m"
"                Rainfall losses           37.589     10.785     24.187     mm"
"                Runoff depth              34.212     61.017     47.614     mm"
"                Runoff volume             11.97      21.36      33.33      c.m"
"                Maximum flow              0.008      0.021      0.026      c.m/sec"
"
" 40             HYDROGRAPH Add Runoff "
"               4   Add Runoff "
"                      0.026     0.240     0.090     0.000"
"
" 51             PIPE DESIGN"
"           0.240   Current peak flow    c.m/sec"
"           0.015   Manning 'n'"
"           0.500   Diameter    metre"
"           0.500   Gradient    %"
"                Surcharged HGL                 0.536    %"
"                Velocity                       1.221    m/sec"
"                Pipe capacity                  0.231    c.m/sec"
"                Critical depth                 0.000    metre"
"
" 53             ROUTE 10"
"           10.00   Reach length( metre)"
```

```
"        0.264   Pervious Area"
"       60.000   Pervious length"
"        2.000   Pervious slope"
"        0.176   Impervious Area"
"       60.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
                 0.100     0.019     0.208     0.208 c.m/sec"
              Catchment 38           Pervious   Impervious Total Area "
              Surface Area           0.264      0.176      0.440      hectare"
              Time of concentration  17.393     2.312      8.961      minutes"
              Time to Centroid       112.842    83.216     96.279     minutes"
              Rainfall depth         71.801     71.801     71.801     mm"
              Rainfall volume        189.55     126.37     315.92     c.m"
              Rainfall losses        37.251     6.088      24.786     mm"
              Runoff depth           34.550     65.713     47.015     mm"
              Runoff volume          91.21      115.66     206.87     c.m"
              Maximum flow           0.033      0.087      0.100      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
            4   Add Runoff "
                  0.100     0.119     0.208     0.208"
" 54         POND DESIGN"
          0.119   Current peak flow    c.m/sec"
          250.0   Hydrograph volume    c.m/sec"
             6.   Number of stages"
          0.000   Minimum water level    c.m/sec"
          0.750   Maximum water level    c.m/sec"
              0   Keep Design Data: 1 = True; 0 = False"
                    Level Discharge    Volume"
                    0.000     0.000      0.0"
                    0.300     0.001      0.1"
                    0.450     0.001      4.7"
                    0.600     0.001     37.1"
                    0.740     0.001     72.0"
                    0.750     0.096     75.0"
            1.   ORIFICES"
                 Orifice   Orifice   Orifice Number of"
                  invert coefficie  diameter  orifices"
                   0.000     0.600     0.025     1.000"
              Peak outflow                    0.090    c.m/sec"
              Maximum level                   0.749    metre"
              Maximum storage                74.799    c.m"
              Centroidal lag                  5.225    hours"
                 0.100     0.119     0.090     0.208 c.m/sec"
" 40          HYDROGRAPH   Combine    16"
            6   Combine "
           16   Node #"
                "
              Maximum flow                    0.298    c.m/sec"
              Hydrograph volume              1411.251    c.m"
                    0.100     0.119     0.090     0.298"
" 40          HYDROGRAPH   Confluence    16"
            7   Confluence "
           16   Node #"
                "
              Maximum flow                    0.298    c.m/sec"
              Hydrograph volume              1411.251    c.m"
                    0.100     0.298     0.090     0.000"
"
==========================================================================
                              CATCHMENT 39
==========================================================================
" 33          CATCHMENT 39"
            1   Triangular SCS"
            1   Equal length"
            1   SCS method"
           39   ID number"
       50.000   % Impervious"
        0.070   Total Area"
        5.750   Flow length"
        2.000   Overland Slope"
        0.035   Pervious Area"
        5.750   Pervious length"
        2.000   Pervious slope"
        0.035   Impervious Area"
        5.750   Impervious length"
        2.000   Impervious slope"
        0.250   Pervious Manning 'n'"
       81.000   Pervious SCS Curve No."
        0.481   Pervious Runoff coefficient"
        0.100   Pervious Ia/S coefficient"
        5.958   Pervious Initial abstraction"
        0.015   Impervious Manning 'n'"
       98.000   Impervious SCS Curve No."
        0.925   Impervious Runoff coefficient"
        0.100   Impervious Ia/S coefficient"
        0.518   Impervious Initial abstraction"
                 0.026     0.298     0.090     0.000 c.m/sec"
              Catchment 39           Pervious   Impervious Total Area "
              Surface Area           0.035      0.035      0.070      hectare"
              Time of concentration  4.259      0.566      1.893      minutes"
              Time to Centroid       94.699     81.236     86.073     minutes"
              Rainfall depth         71.801     71.801     71.801     mm"
              Rainfall volume        25.13      25.13      50.26      c.m"
```

```
"              Runoff depth              34.409      64.409      34.409      mm"
"              Runoff volume             34.41       0.00        34.41       c.m"
"              Maximum flow              0.019       0.000       0.019       c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                    0.019     0.019     0.284     0.284"
================================================================
                              CATCHMENT 41
================================================================
" 33           CATCHMENT 41"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            41   ID number"
"        40.000   % Impervious"
"         0.440   Total Area"
"        60.000   Flow length"
"         2.000   Overland Slope"
"         0.264   Pervious Area"
"        60.000   Pervious length"
"         2.000   Pervious slope"
"         0.176   Impervious Area"
"        60.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.925   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                    0.100     0.019     0.284     0.284 c.m/sec"
"                 Catchment 41            Pervious   Impervious Total Area "
"                 Surface Area            0.264      0.176      0.440      hectare"
"                 Time of concentration   17.393     2.312      8.961      minutes"
"                 Time to Centroid        112.842    83.216     96.279     minutes"
"                 Rainfall depth          71.801     71.801     71.801     mm"
"                 Rainfall volume         189.55     126.37     315.92     c.m"
"                 Rainfall losses         37.251     6.088      24.786     mm"
"                 Runoff depth            34.550     65.713     47.015     mm"
"                 Runoff volume           91.21      115.66     206.87     c.m"
"                 Maximum flow            0.033      0.087      0.100      c.m/sec"
" 40              HYDROGRAPH Add Runoff "
"                4   Add Runoff "
"                       0.100     0.119     0.284     0.284"
" 54              POND DESIGN"
"            0.119   Current peak flow    c.m/sec"
"            250.0   Hydrograph volume    c.m/sec"
"               6.   Number of stages"
"            0.000   Minimum water level    c.m/sec"
"            0.750   Maximum water level    c.m/sec"
"                0   Keep Design Data: 1 = True; 0 = False"
"                      Level Discharge    Volume"
"                      0.000     0.000      0.0"
"                      0.300     0.001      0.1"
"                      0.450     0.001      4.7"
"                      0.600     0.001     37.1"
"                      0.740     0.001     72.0"
"                      0.750     0.096     75.0"
"               1.   ORIFICES"
"                    Orifice   Orifice   Orifice Number of"
"                     invert coefficie  diameter  orifices"
"                      0.000     0.600     0.025     1.000"
"                 Peak outflow                        0.090    c.m/sec"
"                 Maximum level                       0.749    metre"
"                 Maximum storage                    74.799    c.m"
"                 Centroidal lag                      5.225    hours"
"                       0.100     0.119     0.090     0.284 c.m/sec"
" 40              HYDROGRAPH   Combine    17"
"               6   Combine "
"              17   Node #"
"                   "
"                 Maximum flow                        0.372    c.m/sec"
"                 Hydrograph volume                1672.472    c.m"
"                       0.100     0.119     0.090     0.372"
" 40              HYDROGRAPH Start - New Tributary"
"                 2   Start - New Tributary"
"                       0.100     0.000     0.090     0.372"
================================================================
                              CATCHMENT 42
================================================================
" 33           CATCHMENT 42"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            42   ID number"
"        50.000   % Impervious"
"         0.110   Total Area"
"         5.750   Flow length"
"         2.000   Overland Slope"
"         0.055   Pervious Area"
"         5.750   Pervious length"
"         2.000   Pervious slope"
"         0.055   Impervious Area"
"         5.750   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
```

```
"          43   ID number"
"       50.000   % Impervious"
"        0.110   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.055   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.055   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                  0.040     0.000     0.377     0.377 c.m/sec"
"             Catchment 43          Pervious   Impervious Total Area "
"             Surface Area          0.055      0.055      0.110      hectare"
"             Time of concentration 4.259      0.566      1.893      minutes"
"             Time to Centroid      94.699     81.236     86.073     minutes"
"             Rainfall depth        71.801     71.801     71.801     mm"
"             Rainfall volume       39.49      39.49      78.98      c.m"
"             Rainfall losses       37.589     10.785     24.187     mm"
"             Runoff depth          34.212     61.017     47.614     mm"
"             Runoff volume         18.82      33.56      52.38      c.m"
"             Maximum flow          0.013      0.033      0.040      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                  0.040     0.040     0.377     0.377"
" 52          CHANNEL DESIGN"
"         0.040   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         1.500   Basewidth    metre"
"         2.000   Left bank slope"
"         2.000   Right bank slope"
"         0.900   Channel depth    metre"
"         3.000   Gradient   %"
"              Depth of flow                0.043    metre"
"              Velocity                     0.584    m/sec"
"              Channel capacity             9.717    c.m/sec"
"              Critical depth               0.041    metre"
" 53          ROUTE 93"
"        93.00   Reach length( metre)"
"        0.495   X-factor <= 0.5"
"      119.334   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.500   Beta weighting factor"
"      100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.033    c.m/sec"
"                  0.040     0.040     0.033     0.377 c.m/sec"
" 40          HYDROGRAPH   Combine    18"
"            6   Combine "
"           18   Node #"
"                "
"             Maximum flow                 0.398    c.m/sec"
"             Hydrograph volume         1777.156    c.m"
"                  0.040     0.040     0.033     0.398"
" 40          HYDROGRAPH   Confluence    18"
"            7   Confluence "
"           18   Node #"
"                "
"             Maximum flow                 0.398    c.m/sec"
"             Hydrograph volume         1777.156    c.m"
"                  0.040     0.398     0.033     0.000"
" 52          CHANNEL DESIGN"
"         0.398   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         1.500   Basewidth    metre"
"         2.000   Left bank slope"
"         2.000   Right bank slope"
"         0.900   Channel depth    metre"
"         0.600   Gradient   %"
"              Depth of flow                0.262    metre"
"              Velocity                     0.752    m/sec"
"              Channel capacity             4.346    c.m/sec"
"              Critical depth               0.177    metre"
" 53          ROUTE 16"
"        16.00   Reach length( metre)"
"        0.000   X-factor <= 0.5"
"       15.952   K-lag   ( seconds)"
"        0.000   Default(0) or user spec.(1) values used"
"        0.500   X-factor <= 0.5"
"       30.000   K-lag   ( seconds)"
"        0.608   Beta weighting factor"
"       37.500   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                 0.386    c.m/sec"
"                  0.040     0.398     0.386     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"            5   Next link "
"                  0.040     0.386     0.386     0.000"
```

```
"           1   SCS method"
"          22   ID number"
"      50.000   % Impervious"
"       0.090   Total Area"
"       5.750   Flow length"
"       2.000   Overland Slope"
"       0.045   Pervious Area"
"       5.750   Pervious length"
"       2.000   Pervious slope"
"       0.045   Impervious Area"
"       5.750   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      81.000   Pervious SCS Curve No."
"       0.481   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       5.958   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.925   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.033     0.000     0.789     0.789 c.m/sec"
"            Catchment 22           Pervious   Impervious Total Area "
"            Surface Area           0.045      0.045      0.090      hectare"
"            Time of concentration  4.259      0.566      1.893      minutes"
"            Time to Centroid       94.699     81.236     86.073     minutes"
"            Rainfall depth         71.801     71.801     71.801     mm"
"            Rainfall volume        32.31      32.31      64.62      c.m"
"            Rainfall losses        37.589     10.785     24.187     mm"
"            Runoff depth           34.212     61.017     47.614     mm"
"            Runoff volume          15.40      27.46      42.85      c.m"
"            Maximum flow           0.011      0.027      0.033      c.m/sec"
" 40         HYDROGRAPH Add Runoff "
"          4   Add Runoff "
"                   0.033     0.033     0.789     0.789"
"           CHANNEL DESIGN"
" 52     0.033   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"            Depth of flow                  0.065    metre"
"            Velocity                       0.308    m/sec"
"            Channel capacity               3.967    c.m/sec"
"            Critical depth                 0.036    metre"
"           ROUTE 32"
" 53    32.00   Reach length( metre)"
"       0.379   X-factor <= 0.5"
"      77.910   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"      75.000   Routing time step   ( seconds)"
"           1   No. of sub-reaches"
"            Peak outflow                   0.026    c.m/sec"
"                   0.033     0.033     0.026     0.789 c.m/sec"
"           HYDROGRAPH   Combine    19"
" 40       6   Combine "
"         19   Node #"
"              "
"            Maximum flow                   0.799    c.m/sec"
"            Hydrograph volume           4131.400    c.m"
"                   0.033     0.033     0.026     0.799"
"           HYDROGRAPH Start - New Tributary"
" 40       2   Start - New Tributary"
"                   0.033     0.000     0.026     0.799"
"=================================================================="
"                                CATCHMENT 23"
"=================================================================="
" 33        CATCHMENT 23"
"           1   Triangular SCS"
"           1   Equal length"
"           1   SCS method"
"          23   ID number"
"      40.000   % Impervious"
"       0.440   Total Area"
"      56.300   Flow length"
"       2.000   Overland Slope"
"       0.264   Pervious Area"
"      56.300   Pervious length"
"       2.000   Pervious slope"
"       0.176   Impervious Area"
"      56.300   Impervious length"
"       2.000   Impervious slope"
"       0.250   Pervious Manning 'n'"
"      81.000   Pervious SCS Curve No."
"       0.481   Pervious Runoff coefficient"
"       0.100   Pervious Ia/S coefficient"
"       5.958   Pervious Initial abstraction"
"       0.015   Impervious Manning 'n'"
"      98.000   Impervious SCS Curve No."
"       0.925   Impervious Runoff coefficient"
"       0.100   Impervious Ia/S coefficient"
"       0.518   Impervious Initial abstraction"
"                   0.100     0.000     0.026     0.799 c.m/sec"
"            Catchment 23           Pervious   Impervious Total Area "
"            Surface Area           0.264      0.176      0.440      hectare"
```

```
"                invert coefficie  diameter  orifices"
"                 0.000     0.600     0.025     1.000"
"             Peak outflow                        0.068    c.m/sec"
"             Maximum level                       0.750    metre"
"             Maximum storage                    74.979    c.m"
"             Centroidal lag                      5.331   hours"
"                0.129     0.129     0.068     0.854 c.m/sec"
" 40          HYDROGRAPH   Combine    20"
"            6   Combine "
"           20   Node #"
"                "
"             Maximum flow                        0.068    c.m/sec"
"             Hydrograph volume                 198.813    c.m"
"                    0.129     0.129     0.068     0.068"
" 40          HYDROGRAPH Start - New Tributary"
"            2   Start - New Tributary"
"                    0.129     0.000     0.068     0.068"
=================================================================
                              CATCHMENT 46
=================================================================
" 33          CATCHMENT 46"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           46   ID number"
"       50.000   % Impervious"
"        0.110   Total Area"
"        5.750   Flow length"
"        2.000   Overland Slope"
"        0.055   Pervious Area"
"        5.750   Pervious length"
"        2.000   Pervious slope"
"        0.055   Impervious Area"
"        5.750   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       81.000   Pervious SCS Curve No."
"        0.481   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        5.958   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.925   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                    0.040     0.000     0.068     0.068 c.m/sec"
"             Catchment 46          Pervious   Impervious Total Area "
"             Surface Area          0.055      0.055      0.110      hectare"
"             Time of concentration 4.259      0.566      1.893      minutes"
"             Time to Centroid      94.699     81.236     86.073     minutes"
"             Rainfall depth        71.801     71.801     71.801     mm"
"             Rainfall volume       39.49      39.49      78.98      c.m"
"             Rainfall losses       37.589     10.785     24.187     mm"
"             Runoff depth          34.212     61.017     47.614     mm"
"             Runoff volume         18.82      33.56      52.38      c.m"
"             Maximum flow          0.013      0.033      0.040      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.040     0.040     0.068     0.068"
" 52          CHANNEL DESIGN"
"        0.040   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
"        1.500   Basewidth    metre"
"        2.000   Left bank slope"
"        2.000   Right bank slope"
"        0.900   Channel depth    metre"
"        0.500   Gradient   %"
"             Depth of flow                  0.074    metre"
"             Velocity                       0.331    m/sec"
"             Channel capacity               3.967    c.m/sec"
"             Critical depth                 0.041    metre"
" 53          ROUTE 47"
"       47.00   Reach length( metre)"
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"     106.467   K-lag   ( seconds)"
"       0.000   Default(0) or user spec.(1) values used"
"       0.500   X-factor <= 0.5"
"      30.000   K-lag   ( seconds)"
"       0.500   Beta weighting factor"
"     100.000   Routing time step   ( seconds)"
"            1   No. of sub-reaches"
"             Peak outflow                   0.032    c.m/sec"
"                    0.040     0.040     0.032     0.068 c.m/sec"
" 40          HYDROGRAPH   Combine    20"
"            6   Combine "
"           20   Node #"
"                "
"             Maximum flow                   0.088    c.m/sec"
"             Hydrograph volume            251.188    c.m"
"                    0.040     0.040     0.032     0.088"
" 40          HYDROGRAPH   Confluence    20"
"            7   Confluence "
"           20   Node #"
"                "
"             Maximum flow                   0.088    c.m/sec"
"             Hydrograph volume            251.188    c.m"
"                    0.040     0.088     0.032     0.000"
" 52          CHANNEL DESIGN"
"        0.088   Current peak flow    c.m/sec"
"        0.035   Manning 'n'"
"           0.   Cross-section type: 0=trapezoidal; 1=general"
```

```
"              Peak outflow                    0.275    c.m/sec"
"                    0.022     0.278     0.275     0.000 c.m/sec"
" 40          HYDROGRAPH Next link "
"             5   Next link "
"                    0.022     0.275     0.275     0.000"
"
" 52          CHANNEL DESIGN"
"         0.275   Current peak flow    c.m/sec"
"         0.035   Manning 'n'"
"            0.   Cross-section type: 0=trapezoidal; 1=general"
"         1.500   Basewidth    metre"
"         2.000   Left bank slope"
"         2.000   Right bank slope"
"         0.900   Channel depth    metre"
"         0.420   Gradient   %"
"               Depth of flow                 0.235    metre"
"               Velocity                      0.594    m/sec"
"               Channel capacity              3.636    c.m/sec"
"               Critical depth                0.141    metre"
" 53          ROUTE 46"
"         46.10   Reach length( metre)"
"         0.160   X-factor <= 0.5"
"        58.209   K-lag    ( seconds)"
"         0.000   Default(0) or user spec.(1) values used"
"         0.500   X-factor <= 0.5"
"        30.000   K-lag    ( seconds)"
"         0.500   Beta weighting factor"
"        75.000   Routing time step    ( seconds)"
"             1   No. of sub-reaches"
"               Peak outflow                  0.273    c.m/sec"
"                    0.022     0.275     0.273     0.000 c.m/sec"
" 40          HYDROGRAPH   Combine    8"
"             6   Combine "
"             8   Node #"
"                 "
"               Maximum flow                  0.273    c.m/sec"
"               Hydrograph volume          1638.487    c.m"
"                    0.022     0.275     0.273     0.273"
" 40          HYDROGRAPH Start - New Tributary"
"             2   Start - New Tributary"
"                    0.022     0.000     0.273     0.273"
================================================================
                              CATCHMENT 17
================================================================
" 33          CATCHMENT 17"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"            17   ID number"
"        40.000   % Impervious"
"         0.460   Total Area"
"        56.100   Flow length"
"         2.000   Overland Slope"
"         0.276   Pervious Area"
"        56.100   Pervious length"
"         2.000   Pervious slope"
"         0.184   Impervious Area"
"        56.100   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        81.000   Pervious SCS Curve No."
"         0.481   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         5.958   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.925   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      0.104     0.000     0.273     0.273 c.m/sec"
"
"                 Catchment 17            Pervious   Impervious Total Area "
"                 Surface Area            0.276      0.184      0.460      hectare"
"                 Time of concentration   16.705     2.221      8.601      minutes"
"                 Time to Centroid        111.906    83.063     95.769     minutes"
"                 Rainfall depth          71.801     71.801     71.801     mm"
"                 Rainfall volume         198.17     132.11     330.29     c.m"
"                 Rainfall losses         37.298     6.069      24.807     mm"
"                 Runoff depth            34.503     65.732     46.994     mm"
"                 Runoff volume           95.23      120.95     216.17     c.m"
"                 Maximum flow            0.036      0.092      0.104      c.m/sec"
"
" 40               HYDROGRAPH Add Runoff "
"                 4   Add Runoff "
"                        0.104     0.104     0.273     0.273"
"
" 54               POND DESIGN"
"             0.104   Current peak flow    c.m/sec"
"             220.0   Hydrograph volume    c.m/sec"
"                6.   Number of stages"
"             0.000   Minimum water level    c.m/sec"
"             0.750   Maximum water level    c.m/sec"
"                 0   Keep Design Data: 1 = True; 0 = False"
"                       Level Discharge    Volume"
"                       0.300     0.000      0.0"
"                       0.300     0.001      0.1"
"                       0.450     0.001      4.7"
"                       0.600     0.001     37.1"
"                       0.740     0.001     72.0"
"                       0.750     0.076     75.0"
"
"                1.   ORIFICES"
"                     Orifice   Orifice   Orifice Number of"
"                      invert coefficie  diameter  orifices"
"                       0.000     0.600     0.025     1.000"
"
"                   Peak outflow                  0.076    c.m/sec"
"                   Maximum level                 0.750    metre"
```

Midusss98 Steve Brown - AGM Engineering Ltd. Tuesday, June 08,2004,09:48 AM

File Options Hydrology Hydrograph Design Show Automatic Tools Window Help

ROUTE

Last conduit

Type	Channel - simple	
Channel depth	0.900	metre
Gradient	0.500	%
Manning 'n'	0.035	
Depth of flow	0.434	metre
Flow capacity	3.967	c.m/sec

Peak Inflow	0.927	c.m/sec
Reach length	10	metre
X-factor <= 0.5	0.000	
K-lag	8.9	seconds
Peak Outflow	0.923	c.m/sec

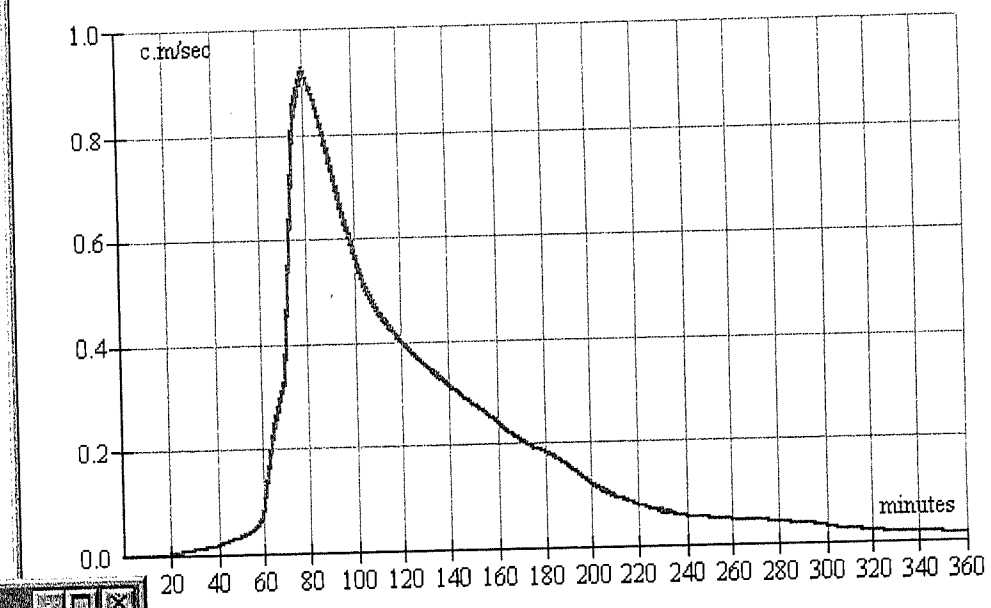
☐ Specify values for X and K

Route Cancel UnDo Accept

Using 1 reaches of length 10.0 metre

Using 7 timesteps of duration 42.9 seconds

Inflow & Outflow Hydrograph



uration 360 minutes

Outflow Hydrograph

Total volume 4581.08 c.m Maximum flow 0.923 c.m/sec 100.0 minutes

	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
5.0	0.000	0.000	0.001	0.003	0.007	0.012	0.017	0.022	0.028	0.035
55.0	0.046	0.070	0.231	0.332	0.826	0.923	0.864	0.765	0.657	0.572
105.0	0.507	0.461	0.429	0.403	0.379	0.358	0.336	0.317	0.298	0.280
155.0	0.262	0.244	0.225	0.208	0.196	0.186	0.175	0.159	0.141	0.125
205.0	0.111	0.100	0.090	0.082	0.075	0.069	0.063	0.059	0.057	0.054
255.0	0.052	0.051	0.049	0.048	0.046	0.044	0.042	0.041	0.039	0.035
305.0	0.032	0.029	0.026	0.024	0.023	0.021	0.020	0.019	0.019	0.019
355.0	0.019	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
405.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
455.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
505.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
555.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018
605.0	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.017
655.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
705.0	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
755.0	0.017	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.016
805.0	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015

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AutoCAD Map 2000 - ... Microsoft Excel - DVE Midusss98 ... Graphics Server ... 9:48 AM

Appendix C

Geotechnical Report

SOLA ENGINEERING

RE: PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL SUBDIVISION
1045 DONNYBROOK DRIVE
DORCHESTER, ONTARIO

FOR: Lantern Capital
2425 Matheson Boulevard East, 8th Floor
Mississauga, Ontario
L4W 5K4

ATTENTION: Mr. Bav Malhi

REPORT NO.: 2021-15454

DATE: June 15, 2021

DISTRIBUTION: PDF Copy: Lantern Capital
- Mr. Bav Malhi [bmalhi@lanterncapital.ca]
- Mr. Stephen Maycher [smaycher@lanterncapital.ca]

Original: (File No. 10826-S0456-GEO)

TABLE OF CONTENTS

TABLES

ENCLOSURES

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Vaughan, Ontario L4K 3Z6
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June 15, 2021

REPORT NO.: 2021-15454
FILE NO.: 10826-S0456-GEO

1.0 INTRODUCTION

Sola Engineering Inc. (Sola) was retained by Lantern Capital (the Client) to carry out a preliminary geotechnical investigation for the proposed industrial subdivision located at 1045 Donnybrook Drive in Dorchester, Ontario (the subject site or site). Authorization to proceed with the investigation was received on April 26, 2021 through the acceptance of Sola's Proposal No. 2021-2716 dated April 21, 2021.

As per the scope of services detailed in Sola's proposal, the purpose of this investigation is to collect information on the soil and groundwater conditions at the subject site and, based on the investigation data to provide recommendations to assist with the preliminary design of the proposed industrial subdivision. It should be noted that a supplementary investigation will be required according to the building footprints for the detailed design.

This report presents the details of Sola's fieldwork and laboratory testing, outlines the soil and groundwater conditions at the site, and provides comments on the aforementioned items.

In this report, standard site investigation procedures have been adopted. The procedures including those developed by the Ontario Building Code (OBC), Canadian Foundation Engineering Manual (CFEM), American Society for Testing and Materials (ASTM), Ontario Ministry of Transportation (MTO) and Toronto Transit Commission (TTC), are considered by far the most accepted methods by the local geotechnical society for the general engineering purposes. Soil Classification Systems used for developing this report have been in general conformance with those outlined in the above-mentioned procedures, with modifications where appropriate. Where in doubt, this office must be contacted for further interpretation or clarification.

This report has been prepared for the Client, and their nominated engineers and designers. Third-party use or reproduction, in part or in full, of this report, is prohibited without written authorization from Sola. This report is also subject to the *Statement of Limitations* which forms an integral part of this document.

2.0 SITE SETTING

2.1 SITE LOCATION, DESCRIPTION AND PROPOSED DEVELOPMENT

The subject site is located at the open field at 1045 Donnybrook Drive in Dorchester, Ontario and is currently vacant. The site is bounded to the north by Donnybrook Drive and residential properties,

to the south by Highway 401, to the west by residential properties and to the east by farm land and tree covered areas.

The subject site is being considered for a industrial subdivision. It is understood that the Client is contemplating developing the site with single-storey slab-on-grade industrial buildings with office spaces.

2.2 PUBLISHED GEOLOGY

Based on a review of the existing geological publication for the site area, Ontario Geological Survey (OGS) Map P0606: "*PleistoceneGeology of the St. Thomas Area (East Half) (Southern Ontario)*", the site surrounding area is underlain by Glacial Erie Lobe, comprising Port Stanley silty clay till and clayey silt till, in places covered by thin patches of lacustrine silt; ground moraine plains and end moraine ridges; slightly undulating microtopography. According to the OGS Map 2197: "*Ontario Geological Map – Southern Sheet*", the surficial overburden is underlain by the bedrock of the Middle Devonian comprising Limestone, Dolostone, Shale and Gypsum.

3.0 GROUND INVESTIGATION

3.1 FIELD INVESTIGATION

3.1.1 Soil Investigation

Prior to undertaking field drilling, Sola obtained clearances of existing public utility services to the site from all applicable agencies and companies. In addition, private utility locates were also carried out.

The geotechnical field program was carried out on May 20, 2021 and comprised the drilling of four (4) boreholes (BH1 through BH4). The boreholes were advanced through the existing ground surface to the depth of approximately 6.6 m below the ground surface using a track-mounted drill rig equiped for split spoon sampling and standard penetration testing. The approximate locations of the boreholes are shown on **Enclosure 1**. Four (4) monitoring wells were installed at borehole locations BH1 through BH4.

All drilling equipment was supplied and operated by Terra Firma Environmental Services Ltd. of North York, Ontario, and the drilling works were completed under the full-time supervision of a qualified Sola Technician.

Standard Penetration Tests (SPTs) split spoon samples were collected in the drilled boreholes using a 50 mm outer diameter and 35 mm inner diameter split barrel sampler driven with a

63.5 kg automatic hammer dropping 760 mm. All soil samples were logged in the field and returned to Sola's laboratory in Vaughan for review and subsequent laboratory testing.

The logs of the boreholes completed are presented on **Enclosures 2 through 5**.

3.1.2 Groundwater Investigation

Groundwater level observations were made during drilling and in the open borehole upon completion of the drilling operations. Upon completion of each borehole, a monitoring well was installed to enable the a longer term monitoring of the groundwater at the site without interference from surface water. Details of groundwater observations for the boreholes are presented on the borehole logs on **Enclosures 2 through 5**. Further discussion on groundwater is provided in **Section 4.2** of this report.

3.2 GEOTECHNICAL LABORATORY TESTING

All soil samples were submitted to Sola's laboratory for natural moisture content determination. The results of the moisture content are presented on the borehole logs on **Enclosures 2 through 5**. In addition, two (2) representative soil samples were selected and submitted for testing of particle size distribution. The results of the laboratory tests are provided on **Enclosures 8 and 9**.

4.0 SUBSURFACE CONDITIONS

The detailed descriptions of the subsurface conditions encountered at each borehole location are given on the Borehole Logs on **Enclosures 2 through 5**.

The borehole data collected by Sola only represents the subsurface conditions at the borehole locations. It should be pointed out that the material boundaries indicated on the Borehole Logs are approximate and based on visual observations and interpolation between successive samples. These boundaries typically represent a transition from one material type to another and should not be regarded as an exact plane of geological change. It should also be noted that the subsurface conditions may vary across the site.

A summary of the characteristics for each unit of subsoil encountered within the borehole depths is given in the following paragraphs.

4.1 SOIL CHARACTERISATION

4.1.1 Topsoil

A layer of topsoil was encountered at all borehole locations. The thicknesses of topsoil was

measured to range from approximately 75 mm to 150 mm at the borehole locations.

It is important to note that topsoil thicknesses may vary throughout the site area, depending upon their location. As such, these findings should not be relied upon for any estimation of topsoil quantities to be stripped prior to construction.

4.1.2 Fill Materials (Including Probable Fill)

Fill materials were encountered at all borehole locations. The thicknesses of the fill materials at the borehole locations vary from approximately 0.7 m (BH1) to 1.4 m (BH2 and BH4). In BH1 underlying the fill, a 0.7 m thick layer of soil identified as Probable Fill was contacted. The fill (and probable fill) unit was found to extend to a depth of approximately 1.5 m in all boreholes.

Fill materials generally consisted of silty sand to sandy silt and clayey silt. The fill was generally brown in colour. In-situ resistance testing results ranged from 4 (BH2 and BH4) to 24 (BH1) blows per 300 mm of spoon penetration, indicating that the fill was not constructed under engineering control.

In the fill layer, the moisture content of the samples recovered ranged from 15.9% (BH3) to 21.3% (BH2), indicating a moist condition.

4.1.3 Clayey Silt

A clayey silt deposit was encountered below the fill in borehole BH3 at the depth of approximately 1.5 m and extended to the depth of approximately 2.3 m below the ground surface.

SPT “N” value for the clayey silt layer was recorded to be 11 blows per 300 mm of spoon penetration, indicating that the soil is in a stiff condition.

In the clayey silt soil layer, the moisture content of the sample recovered was approximately 14.4%, indicating a moist condition.

4.1.4 Glacial Till

Clayey silt till and silty clay till deposits were encountered below the fill materials or clayey silt deposit in all borehole locations, at the depth ranging from approximately 1.5 m (BH1, BH2 and BH4) to 2.3 m (BH3) below the ground surface. All boreholes were terminated in these deposits.

The composition of the till was found to change from primarily clayey silt with trace to some sand and gravel to a relatively more clayey till (i.e. silty clay till) with trace of sand and gravel at the depth of about 4.5 m to 6.6 m below the ground surface. Owing to their mode of deposition, the presence of cobbles and boulders should always be anticipated in the glacial till deposits.

SPT "N" values for the glacial till deposits were recorded from 12 (BH2 and BH4) to 36 (BH1) blows per 300 mm of spoon penetration, indicating that the deposits to be in a stiff to hard condition.

In the glacial till deposits, the moisture content of the samples recovered ranged from approximately 12.2% (BH3) to 18.3% (BH1), indicating a moist to very moist condition.

4.2 GROUNDWATER

The groundwater conditions encountered during drilling and cave in depths are presented on the borehole logs on **Enclosures 2 through 5** as well as in **Table 1**.

Table 1: Borehole Water Depth and Cave-in Upon Completion of Drilling

Borehole Number	Water Depth Upon Drilling Completion (mBGS)	Cave-in Depth Upon Drilling Completion (mBGS)	Groundwater Depth (mBGS) taken by Project Hydrogeologist on May 25, 2021
BH1	Dry	Open	4.80
BH2	Dry	Open	1.15
BH3	Dry	Open	4.15
BH4	Dry	Open	3.50

Note: mBGS = meters below ground surface

It should be noted that water levels can vary in response to seasonal fluctuations and major weather events. In addition, a perched water condition can occur due to the accumulation of surface water in the more pervious fill overlying less pervious deposits, especially during seasonally wetter periods.

Long-term "stabilized" groundwater level measurements should refer to the project hydrogeology study.

5.0 DISCUSSION AND RECOMMENDATIONS

The investigation and comments should be considered ongoing as new information about the underground conditions will continue to become available. When more specific information is available with respect to the

soil conditions, the interpretation and the recommendations of this report must therefore be checked through field inspections carried out by Sola to validate the information for use during construction.

For this preliminary investigation, the details of the proposed development have not been made available. It is understood that the Client is contemplating developing the site with single-storey slab-on-grade industrial buildings with office spaces. A supplementary investigation will be required according to the building footprints for the detailed design, when available. Based on the ground conditions found at the site, our recommendations are presented in the following sections.

5.1 FROST PROTECTION

All footings and structural elements exposed to seasonal freezing conditions must have at least 1.2 metres of permanent soil cover, or equivalent artificial insulation, for frost protection.

5.2 CONVENTIONAL SPREAD OR STRIP FOUNDATIONS

At the time of preparation of this report, design loading requirements have not been made available. The following discussions are provided to assist the preliminary design phase of the proposed industrial subdivision. For geotechnical design purposes, it is assumed that the footings will be positioned below the frost penetration depth, i.e., at least 1.2 m below the finished grade.

Based on borehole data, the proposed industrial development can be supported by spread and strip footings founded on undisturbed native soil and designed for geotechnical reactions at Serviceability Limit States (SLS) and factored geotechnical resistances at Ultimate Limit States (ULS) at the depths as outlined in **Table 2**.

Table 2: Bearing Resistances and Founding Depths

Borehole Number	SLS (kPa)	ULS (kPa)	Founding Depth (mBGS)	Founding Stratum
BH1	200	300	1.5	Clayey Silt Till
BH2	120	180	1.5	Clayey Silt Till
	160	240	2.3	Clayey Silt Till
BH3	100	150	1.5	Clayey Silt
	160	240	2.3	Clayey Silt Till
BH4	200	300	1.5	Clayey Silt Till

It is assumed that the dimensions of the footing units will not be greater than 3 x 3 m (square) or 1.0 m wide (strip). Larger footings may yield larger settlements and must be reviewed by the Geotechnical Engineer during the detailed structural design.

Alternatively, the footings can be founded on engineered fill. This would involve stripping of the existing fill to the surface of suitable native soils, inspecting and compacting from the surface, and backfilling in shallow layers of not more than 300 mm in thickness when first placed i.e., before applying compaction. Each layer would be compacted to not less than 100% of the Standard Proctor Maximum Dry Density (SPMDD). Imported granular fill would be utilized for this purpose. The entire process would be conducted under the supervision of geotechnical personnel from this office. An SLS value of 150 to 200 kPa and a ULS value of 225 to 300 kPa can be utilized depending on the property of the fill used and compaction procedures, including the degree of compaction. We will be pleased to provide more details of this procedure if it is to be considered.

Alternatively, a “trench-and-pour” construction technique can be utilized. In order to facilitate the construction, it is prudent to excavate a few test pits prior to construction in the general area to examine whether the trench walls can remain relatively stable for the proposed footing construction.

The design values provided above are based on the presumption that the bearing resistance at SLS is governed by total and differential settlements of 25 mm and 19 mm respectively, and the structure will tolerate an angular distortion of 1 in 300.

Where it is necessary to place footings on the soil at a different level, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line (10H:7V) drawn up from the base of the lower footing. The lower footing must be installed first to minimize the risk of undermining the upper footing.

Footings and any foundation wall should be reinforced as per the design to be provided by the Structural Engineer of the project.

The recommended bearing resistances and the corresponding founding elevations would need to be confirmed by geotechnical engineering staff at the site prior to pouring footing concrete.

It should be noted that the recommended bearing resistances have been calculated by Sola from the borehole information for the design stage only. Should higher bearing values be required, this office should be contacted to review this report.

Foundation walls and columns should be protected against heave due to adfreeze. Where construction is undertaken during winter conditions, footing subgrades should be protected from freezing.

5.3 EARTHQUAKE CONSIDERATIONS

Using the information provided by the site investigation, the general soil profile comprises *"Stiff Soil – Site Class D"* as defined by Table 4.1.8.4.A *"Site Classification for Seismic Site Response"* of the Ontario Building Code.

For industrial building construction, cost savings may be achieved if the Site Classification can be upgraded through shear wave velocity testing. This testing can be carried out by a specialist geophysics firm.

5.4 SLAB-ON-GRADE CONSTRUCTION

The existing topsoil and fill within the proposed building footprint should be removed to a depth of not less than 1.0 m below the exsiting ground surface. Depending on the design grade and loading conditions, some of the existing geotechnically and environmentally clean fill may be reused to raise the grade after striping to a depth of 0.5 m below the proposed floor slab, depending on the loading consitions. After striping, the exposed soil subgrade must be inspected, evaluated and approved. The approved subgrade should then be proof rolled to detect any soft or unstable areas, which must be removed and replaced with suitably compacted engineered fill, as defined in **Section 5.9** of this report. Once the required subgrade has been developed, Sola recommends that the exposed subgrade be inspected and approved by the Geotechnical Engineer before the placement of any granular fill or concrete.

For highly loaded floor areas (i.e., warehouses, etc.) sensitive to settlements, it is recommended that engineered fill be used. For this purpose, the site should be stripped of all the existing fill, and the subgrade should be approved by Sola. Upon approval, the on-site excavated clean selected material can be used to raise the grade to a depth of about 1.0 m below the bottom of the floor slab. We recommend that the remaining portion of the fill should consist of imported clean granular fill such as Granular 'B' material, type 2. Under light-loaded floor areas, which may not be sensitive to settlements, the existing fill can selectively be used to raise the grade to a depth of 0.5 m below the underside of the floor slab. For normal duty concrete floor-slab, it is recommended that an at least 200 mm thick layer of either OPSS Granular A or 20 mm Crusher-Run Limestone (to top over and above the Granular 'B') should be used and compacted to at least 100% SPMDD. For heavy-duty floor slabs, the granular thickness should be increased to 300 mm. These recommendations need to be adjusted when the details are known.

The minimum acceptable degree of compaction for the backfill typically ranges between 98% and 100% of the SPMDD depending on the details of the project.

It is considered by Sola that completed excavations for floor slabs should not be left open before pouring concrete for any period longer than 24 hours, particularly if the floor construction works are being completed during the winter months or wet weather periods. The base of any floor slab excavation that is to be left exposed for longer than 24 hours should be suitably covered and protected from water ponding, and/or protected to prevent degradation of the exposed founding stratum with the construction of a mud mat.

Prior to placing the stone bedding, the final subgrade should be proof-rolled and approved by a Geotechnical Engineer.

The design of the concrete slabs on improved fill may be made on the basis of a value of modulus of subgrade reaction which is 15 MPa/m on the surface of the granular moisture barrier.

The floor slab should be structurally independent from any load-bearing structural elements.

5.5 PERMANENT DRAINAGE CONSIDERATIONS

The finished exterior ground surface should be sloped away from the proposed industrial development area at a minimum cross-fall of 2%.

Perimeter drainage should be provided around all floor slab areas where water may accumulate. The perimeter drainage is not required if the interior finish floor elevation is at least 200 mm higher than the exterior elevation. If the interior finish floor elevation is less than 200 mm, this office should be contacted, and the drainage details can be provided. Based on the groundwater condition at the site, underfloor drains may not be required, however, the need for a subfloor drainage system should be determined by the designer in accordance with the latest Ontario Building Code requirements.

5.6 SITE PREPARATORY WORKS

The site preparation work may include stripping of the ground cover and existing fill in order to develop the required construction or engineered fill subgrades. Depending on the final grading plan, stripping depths will likely vary locally and should be adjusted to remove all unsuitable material.

It is recommended that the Geotechnical Engineer monitor the stripping operations to ensure that unsuitable materials have been fully removed prior to construction works or the placement of engineered fill. Unacceptable areas identified are to be remediated as soon as practicable and, the procedures would be dependent upon conditions encountered.

5.7 EXCAVATABILITY AND SITE EXCAVATIONS

It has been assumed that in general excavations for the building and utilities will be open cut. In order to enable entry into excavations during the construction process, all excavations must comply with the definitions prescribed by the "*Occupational Health and Safety Act*" (OHSA), Ontario Regulation 213/91 "*Construction Projects*".

Unless properly tapered, the sides of the excavation will not remain stable for a prolonged period of time. The borehole data indicate that the native glacial till deposits can be classified as a Type 2 material as defined in the OHSA and Regulations for Construction Projects (Part III Excavations, Section 226); native clayey silt deposit and fill, Type 3 above groundwater and Type 4 below groundwater. Excavations in these materials should be constructed in conformance with the regulations. It is noted that the above classifications have been estimated based on small, discontinuous samples from boreholes. The excavation conditions must be confirmed and/or modified on the basis of field inspections during the construction stage when large-scale observations can be made with ease.

As defined by the OHSA, excavation walls within the Type 3 soils will require battering back at slopes no steeper than 1H (horizontal):1V (vertical) and flatter for Type 4 material. Within the fill materials, a flatter than 1:1 side slope may be required even above the water table. For Type 2 material, the bottom 1.2 m high of the trench wall can be vertical, for temporary conditions.

Depending on the construction feasibility the excavation walls can be supported by temporary shoring systems. During excavations, adjacent existing structures and public right of way, if present, must be protected by proper shoring or sloping.

Based on the findings of the investigation, it is considered that excavation of the overburden soils at the site can be carried out using a conventional backhoe excavator.

It is important to note that the above discussion about the excavation is for information purposes only. Contractor bidding on the projects must make their own assessment based on the real site conditions.

Cobbles and boulders were inferred in the boreholes and are expected to be in the glacial till deposits. The contractor carrying out the excavation work should account for removing cobbles and boulders in their site excavation work.

It is assumed that the groundwater will be lowered to 1.0 m below the required excavation depth to enable the construction to be carried out in the 'dry' condition. It is expected that the 'perched water'

can be controlled by the conventional 'sump and pump' methodology. If more aggressive dewatering methods are required, a dewatering specialist should be consulted.

5.8 CONSTRUCTION DEWATERING

The borehole data have indicated that no unusual groundwater seepage problems should be expected during excavation and 'perched water' can be controlled by conventional sump pumping. However, the construction dewatering requirements should refer to the project hydrogeology study.

5.9 ENGINEERED FILL

On-site excavated, clean inorganic earth (native and/or fill) may selectively be reused as engineered fill material, provided that the moisture contents are strictly controlled.

If imported inorganic mineral soils are used for engineered fill construction, they must meet the applicable environmental guidelines, and their moisture contents should preferably be close to their respective optimum water content values.

The soil should be placed in thin lifts and suitable compaction equipment should be employed to achieve the specified degree of field density. The on site excavated clayey soils can be expected to require heavy sheepsfoot or padfoot type compacters to achieve a high degree of compaction. However, vibrations due to compaction may need to be reduced or curtailed to prevent damage to the existing structures and public right of way.

Consideration may also be given to backfilling excavations with a well-graded, compacted granular soil such as Granular B as it, if thoroughly compacted, would reduce the post-construction settlements to an acceptable level and may also expedite the compaction process.

Fill materials required for replacing locally softened soils or raising grades within the footprint of the structures and paved areas are to comprise suitably organic free materials approved for use by a Geotechnical Engineer. Fill materials are to be placed in lifts of a maximum thickness of 300 mm and compacted, using appropriate compaction equipment, to at least 98 % of its SPMDD.

Fill located in areas outside of the footprint of any proposed structure or paved areas should be compacted to at least 95 % of the material's SPMDD below 1.0 m of the subgrade level, and then to at least 98 % of its SPMDD up to the required grade. Imported granular fill used in confined areas should be compacted using only hand-held compaction equipment only.

Sola recommends that any and all engineered subgrades beneath proposed structures including

pavements be inspected and proof rolled prior to construction.

5.10 PAVEMENT

Pavement structure adjoining the proposed construction areas should be protected from damages resulting from construction activities. All heavy vehicles should be appropriately planned and re-routed to avoid such damages.

5.10.1 Pavement Thickness Design

For pavement construction, if contemplated, the existing subgrade soils, when compacted and proof rolled in the presence of Geotechnical personnel, can be expected to be competent to support a conventional pavement structural thickness. Any unsuitable soils, such as topsoil/organic mixed soil and other spongy materials, if found, should be sub-excavated and replaced with approved materials and the profiled subgrade compacted to not less than 98% of its SPMDD.

The pavement construction may consist of upfilling (if applicable) from the prepared subgrade surface to the underside of the granular base layer using a well-graded granular subbase material (OPSS Granular B-Type I) up to a maximum thickness of 500 mm. The material should be laid and compacted in thin lifts to at least 100% of their SPMDD. Per the County of Middlesex's Standard Details, we recommend the pavement design shown in **Table 3**. It is assumed that there will be only occasional delivery trucks allowed for light-duty areas. In the areas where fire routes and loading dock approaches, the heavy-duty pavement design should be implemented.

Table 3: Recommended Pavement Design

Pavement Component	Light Duty Thickness (mm)	Heavy-Duty Thickness (mm)	Compaction Requirements
Asphaltic Concrete Surface Course HL-3	40	40	Minimum of 92.0% of Maximum Relative Density (MRD)
Asphaltic Concrete Binder Course HL-8	50	80	
Granular Base (OPSS Granular 'A')	150	150	100% SPMDD
Granular Sub-Base (OPSS Granular 'B')	300	450	

The recommended granular base and sub-base materials shall meet the OPSS 1010 requirements. The granular base and subbase should be compacted to at least 100% of their SPMDD.

The asphaltic concrete courses are to be hot-mixed and hot-laid in accordance with current OPSS specifications and compacted to a minimum of 92% of Maximum Relative Density (MRD).

The pavement design as presented above in **Table 3** assumes that construction will be undertaken under dry weather conditions and that the subgrade is stable and not heaving under construction equipment traffic. However, if the construction conditions are non-ideal, with the final subgrade being wet and/or unstable, additional imported subbase material may become necessary.

The pavement make-up for the entrance driveways should match the respective road pavement design at the road/driveway interface. It may be preferable to use concrete pavements at loading docks.

Prior to placing the granular subbase, the final subgrade should be proof rolled to identify soft spots, if any, and rectified as required in consultation with a Geotechnical Engineer.

The recommended pavement structure should be considered for preliminary design purposes only. The functional design life of eight (8) to ten (10) years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific design life requirements. Such further analysis will also involve specific laboratory tests to determine the frost susceptibility and strength characteristics of the subgrade soils, as well as specific traffic loading data input from the Client.

Pavement Drainage: The ability of the soils to provide adequate subgrade support is reduced if allowed to become too wet. Therefore, in order to intercept infiltrating water and provide drainage of the subgrade and pavement material, it is recommended that 100 mm diameter sub-drains, wrapped in filter cloth, be provided along both sides of the driveways; in addition, similar sub-drains should be installed in four (4) directions from the catch basins and at strategic locations under the parking lot pavement. Furthermore, the subgrade should be graded to promote the flow of water towards the subdrains.

5.10.2 Pavement Construction Considerations

For pavement construction, the subgrade must be compacted to at least 98% SPMDD, for at least the upper 300 mm, unless an alternative is approved by Sola.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved.

Additional comments on the construction of pavement areas are as follows:

- The subgrade preparation should include stripping of any objectionable materials, e.g., loose fill with organics. The subgrade surface should be properly shaped and thoroughly proof rolled using suitable equipment. Soft and/or unstable subgrade areas should be further sub-excavated and backfilled to the design subgrade level using an approved material, placed in thin lifts, and compacted to at least 98% of its SPMDD;
- The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed grading. Assuming that satisfactory crossfalls in the order of 3% have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that flatter crossfalls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by Sola; and,
- The most severe loading conditions on the pavement areas and subgrade may occur during construction. Consequently, special provisions such as restricted access routes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.

It is recommended that Sola be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations in this report.

5.11 Service Installation Considerations (where applicable)

5.11.1 General

The materials found in the boreholes at the expected elevations of the proposed servicing trench generally consist of competent soils. In general, the native materials are suitable for pipeline support. Localized loose/soft subgrade conditions, if encountered during construction, should be sub excavated to a depth of at least 300 mm or to a firm base, if

shallower, and backfilled with clean, compactable materials and stabilized as per the project specifications. If the invert of the pipes falls within the fill soils, the fill should be removed and replaced with engineered fill, unless otherwise directed by the Geotechnical Engineer.

Prior to placement of bedding, the exposed subgrade at the bottom of each servicing trench excavation should be inspected by a Geotechnical Engineer to identify any soft, loose, or disturbed base conditions. All disturbed soils resulting from construction activities should be removed and replaced as noted above.

Design and construction considerations for both flexible (PVC) and rigid (concrete) pipes are included in the following sections.

5.11.2 Excavations and Health and Safety Considerations

The same recommendations as given in **Section 5.7** will generally apply to the excavations for laying of the underground services. The excavated soils should be placed not closer than the depth of the trenches from the trench edge.

5.11.3 Bedding

The improved fill materials and native subgrade in an undisturbed state will provide adequate support for the proposed service pipes and will allow the use of normal Class B type bedding. The bedding should conform to the current Ontario Provincial Standard Specifications (OPSS 1010) and/or the Middlesex County standards for bedding stone gradation requirements. The pipes should be placed with a minimum bedding thickness in conformance with Ontario Provincial Standard Drawing OPSD 802.010 (for flexible pipes) or OPSD 802.031 (for rigid pipes), though the bedding thickness will be subject to variation and ultimately be based on the proposed pipe diameter, bedding specifications used, etc. It is recommended that clear stone should not be used for bedding and as backfill above the obvert of the pipe, as soil fines from the silty subgrade may infiltrate into the voids of the clear stone, giving rise to settlements of the surface pipes and the trench surface, after the trenches are backfilled.

On completion of the servicing pipe installation, a granular surround of the same bedding material should be placed around the pipe to cover it to at least 300 mm above the pipe obvert.

The backfill above the bedding and cover materials may consist of clean, compactable fill. Based on the borehole data it is anticipated that some of the local soil material can selectively be reused as trench backfill, subject to approval by Geotechnical personnel. Some moisture

conditioning of the soil may be required to facilitate soil compaction. In the event that imported soil is used as a trench backfill, it must be ensured that the drainage properties of the subgrade are maintained and that there is no differential frost movement. Trench backfill should be compacted to at least 97% of the material's SPMDD, or Middlesex County standards, whichever is more stringent. Within the top one meter, the degree of compaction should be increased to at least 98% of the SPMDD of the material.

5.11.4 Trench Backfill

Backfilling During Dry-Weather Conditions

The excavated fill soils, if approved by the Geotechnical personnel at the time of construction, are considered suitable for re-use as fill to backfill service trenches, provided that suitable compaction equipment can be used to compact the fill material. However, the clayey soils will require heavy sheepsfoot or padfoot type compactors to achieve a high degree of compaction. The use of heavy compactors in the narrow confined service trenches may not be feasible. In confined areas, consideration may be also given to backfilling the areas with a well-graded, compacted granular soil such as Granular 'B' material. As such material, if thoroughly compacted, would reduce the post-construction settlements to an acceptable level and may also expedite the compaction process. However, proper tapering should be provided to prevent differential frost heave of the paved surface.

Each lift should be no greater than 300 mm thick when first placed and compacted using an appropriate heavy compaction machine to at least 95 % of the material's SPMDD to within 1 m of the top of the subgrade, and then to at least 98 % SPMDD up to the required grade.

Exposed, excavated soil stockpiles that are to be reused as fill on-site should be compacted at the surface or temporarily covered during wet weather to help maintain their original moisture content. Such stockpiles are prone to wet weather exposure and, as such, the increased moisture contents will make these materials too wet to achieve the required levels of compaction.

Conversely, if the excavated soils are too dry to achieve the required levels of compaction, some moisture addition/conditioning by means of water hosing or misting should be expected.

We recommend the subgrade be observed and approved by a Geotechnical Engineer prior to the placement of the bedding material to confirm that the subgrade conditions are consistent with the recommendations given in this report. Where unsuitable subgrade

conditions are observed, remedial procedures can be established in the field to avoid construction delays.

Backfilling During Winter Months

Should this project proceed during the winter months or when the ambient temperatures are below freezing, the following additional recommendations will apply in order to avoid any detrimental effects of frost.

In this situation, it is imperative that the excavation and backfilling operations follow simultaneously. This procedure is required to avoid time gaps between the two construction stages, as prolonged exposure to frost may lead to the inclusion of frozen material during backfilling. It is recommended that prior to resuming backfilling over the frozen surface, all frost should be removed to achieve a satisfactory bond between the current and previously laid fills. Also, this procedure would prevent leaving frozen layers of soils which could cause long-term settlements while undergoing slow thawing.

It is further recommended that any accumulation of water or ice in the small sheepsfoot compactor footprint overnight or weekends should be prevented by adequately shaping up and back blading the compacted grades prior to leaving the site.

In order to ensure that no frozen material is being backfilled in the trenches, it is recommended that the backfilling and compaction operations should be supervised and closely monitored by Sola on a continuous basis.

For the construction of the parking lot, the final subgrade should be prepared during 'dry weather' conditions so as to achieve a satisfactory end product.

5.12 CONSTRUCTION CONSIDERATIONS

Load-bearing soils are susceptible to disturbance from environmental factors (temperature, moisture change, etc.) and construction activity. Therefore, due care should be given to minimizing the trafficking of such areas during periods of excavation and the construction of the floor slab and footings to minimize the disturbance of the bearing soils.

Any excessive disturbances of the load-bearing and underlying soils affected during construction works could influence the long-term settlement of the structures and will therefore require further excavation and replacement of such impacted soils with suitable engineered fill.

During winter seasons, foundations and slab-on-grade construction should be carried out to avoid pouring concrete on frozen soil. Foundations must be adequately protected at all times from cold weather and freezing conditions.

A Geotechnical Engineer should evaluate all subgrade surfaces to confirm that the subgrade and founding conditions are consistent with the recommendations given by this report.

6.0 MATERIAL TESTING AND INSPECTION

It is recommended that Sola be appointed to carry out field inspection and materials testing during construction to ensure that the construction complies with the design recommendations.

7.0 DRAWING REVIEW

Once the final design drawings for this project are prepared, it is recommended that one (1) set of the drawings should be submitted to Sola for review and to make any amendments to our recommendations that may be required, prior to starting construction. Adequacy of the existing subgrade condition should be checked by Sola.

Sola should also be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Sola will assume no responsibility for the interpretation of the recommendations in this report.

The comments given in this report are preliminary and intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should make their own interpretations of the factual borehole results, so that they may draw their own conclusions on how the subsurface conditions may affect them.

The information in this report in no way reflects on the environmental aspects of soil conditions at the site and has not been addressed in this report, since this aspect was beyond the scope and terms of reference.

8.0 CLOSURE

This report is subject to the Statement of Limitations which forms an integral part of this document. The Statement of Limitations is not intended to reduce the level of responsibility accepted by Sola, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

We trust that this report meets your needs. Should you have any queries, please contact the Sola office.

Sincerely,
SOLA ENGINEERING INC.

George Hao P. Eng.

Bill Feng P.Eng.
Chief Engineer

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Enclosures

STATEMENT OF LIMITATIONS

Standard of Care and Basis of this Report
Sola Engineering Inc. ("Sola Engineering") has prepared this report in a manner consistent with generally accepted engineering and/or environmental practices in the jurisdiction in which the specified services were provided. The information and conclusions set out in this report reflects Sola Engineering's best professional judgment in light of the information available to Sola Engineering at the time of preparation. Sola Engineering disclaims any and all warranties, express or implied, including without limitation any warranty of merchantability and/or fitness for a particular purpose, and makes no representations concerning the legal effect, interpretation or significance of this report or the information, conclusions or recommendations contained in it.

The conclusions and recommendations provided in this report have been prepared in relation to the specified site (the "Site") and the proposed project (the "Project"), as described by the Client to Sola Engineering. Given the nature of the work undertaken by Sola Engineering as part of this report, the Client acknowledges that ground conditions may vary over distances and may change over time. Should there arise any changes to the conditions of the Site or the Project (as to purpose or design), Sola Engineering is to be notified within a reasonable period of time, and in any event within 24 hours of the Client's learning of such changes, so as to give Sola Engineering an opportunity to review and revise this report in light of such changes. Sola Engineering accepts no liability or responsibility for any use of this report or reliance on this report following any changes to the conditions of the Site or the Project.

The scope of professional services provided by Sola Engineering for the Project are as set out in this report. Should such services be limited to those of a geotechnical nature, Sola Engineering shall not be held liable or responsible for any environmental services that may be required, nor shall this report be interpreted to reflect any environmental aspects of the Project. Alternatively, should such services be limited to those of an environmental nature, Sola Engineering shall not be held liable or responsible for any geotechnical services that may be required, nor shall this report be interpreted to reflect any geotechnical aspects of the Project.

This report is not intended to provide recommendations for possible future conditions or use of the Site or adjoining properties. Should the need arise for such recommendations Sola Engineering may need to conduct further investigations.

Use of this Report
This report is intended to be read and used in its entirety. No reliance may be made upon any individual portion or section of this report without reference to the entire report as a whole. In preparing this report, Sola Engineering has relied on information, instructions and communications given by the Client to Sola Engineering, the applicability, truth and accuracy of which is the sole responsibility of the Client.

This report with the information, sampling data, analysis, conclusions and recommendations contained in it (if any), has been prepared for and may only be used by the Client and only for the specific purpose as specified by the Client to Sola Engineering in connection with the Project. Without prior written consent from Sola Engineering, use of this report or any portion thereof by any person or entity other than the Client, or for any purpose other than as communicated by the Client to Sola Engineering, is strictly prohibited. Sola Engineering accepts no liability or responsibility for the unauthorized use of this report. This report and all documents that form part of it are the sole property of Sola Engineering. Sola Engineering relies on and retains any and all intellectual property rights it has in this report, including any copyright to which it is entitled. The Client shall not give, lend or sell this report, or any portion thereof, to any entity, person or association without the express prior written consent of Sola Engineering. This report and the information contained herein shall be treated as strictly confidential.

The contents of this report, inclusive of Sola Engineering's conclusions and recommendations in relation to the Project, are intended only for the guidance of the Client in carrying out the specified services for the Project, as described by the Client to Sola Engineering. Accordingly, Sola Engineering does not accept any liability or responsibility for any inaccuracy contained in this report arising as a result of or in any way connected with any exclusion, oversight or falsification of the information provided to Sola Engineering by the Client. This report, including the effect of the subsurface conditions as described in this report, is to be interpreted at the risk and discretion of the Client and any contractors or others bidding on or undertaking contractual work to be performed as part of the Project who may come into possession of or learn of this report or its contents. It is exigent that all contractors bidding or undertaking the work are to rely on their own interpretations of the data contained in this report in addition to their own investigations and conclusions. Sola Engineering shall not be held liable or responsible for any interpretation of or conclusions that may be drawn from the data or information contained in this report.

The information, recommendations and conclusions presented in this report are based on Sola Engineering's interpretation of conditions revealed through the limited investigation conducted within a defined scope of services. In no event will Sola Engineering be held responsible or liable to the Client or any other person or entity for any special, indirect, incidental, punitive or consequential loss or damage (including, loss of use, lost profits or expenses incurred) resulting from or in any way related to the independent interpretations, interpolations, conclusions or decisions of the Client or any other person or entity, based on the information contained in this report. The restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Notwithstanding the exclusions of liability contained herein but without in any way limiting their effect or generality, if there is found to be any finding of liability or responsibility whatsoever on the part of Sola Engineering which in any way relates to or arises from this report, or the information, conclusions or recommendations contained in it, such liability and/or responsibility shall cease and forever be extinguished from and after the date which is two (2) years from the date of this report. In no event shall any liability or responsibility of Sola Engineering exceed the fees charged by Sola Engineering to the Client for the preparation of this report (excluding any arms' length disbursements or expenditures made or incurred by Sola Engineering as a result thereof and reimbursed by the Client).

Site Conditions
The material conditions, classifications, conclusions and recommendations contained in this report were based on the site conditions observed or tested by Sola Engineering or otherwise communicated to Sola Engineering by the Client. The description, identification and classification of soils, rocks, chemical contamination and other materials have been made based on limited investigations, sampling and testing of materials performed by Sola Engineering and its qualified representatives in reliance on the use of relevant or applicable equipment, all in accordance with commonly acceptable standards in the geotechnical and/or environmental disciplines. Accordingly, this report may include assumptions of conditions which are based on discrete sample locations and thus some conditions may not have been detected. The Client accepts all liability and risk for the use of this report and the information and data contained in it. Sola Engineering shall not be held liable or responsible for any conditions beyond the scope of tests conducted on samples of the subsurface and soil conditions of the subject property as set out in this report.

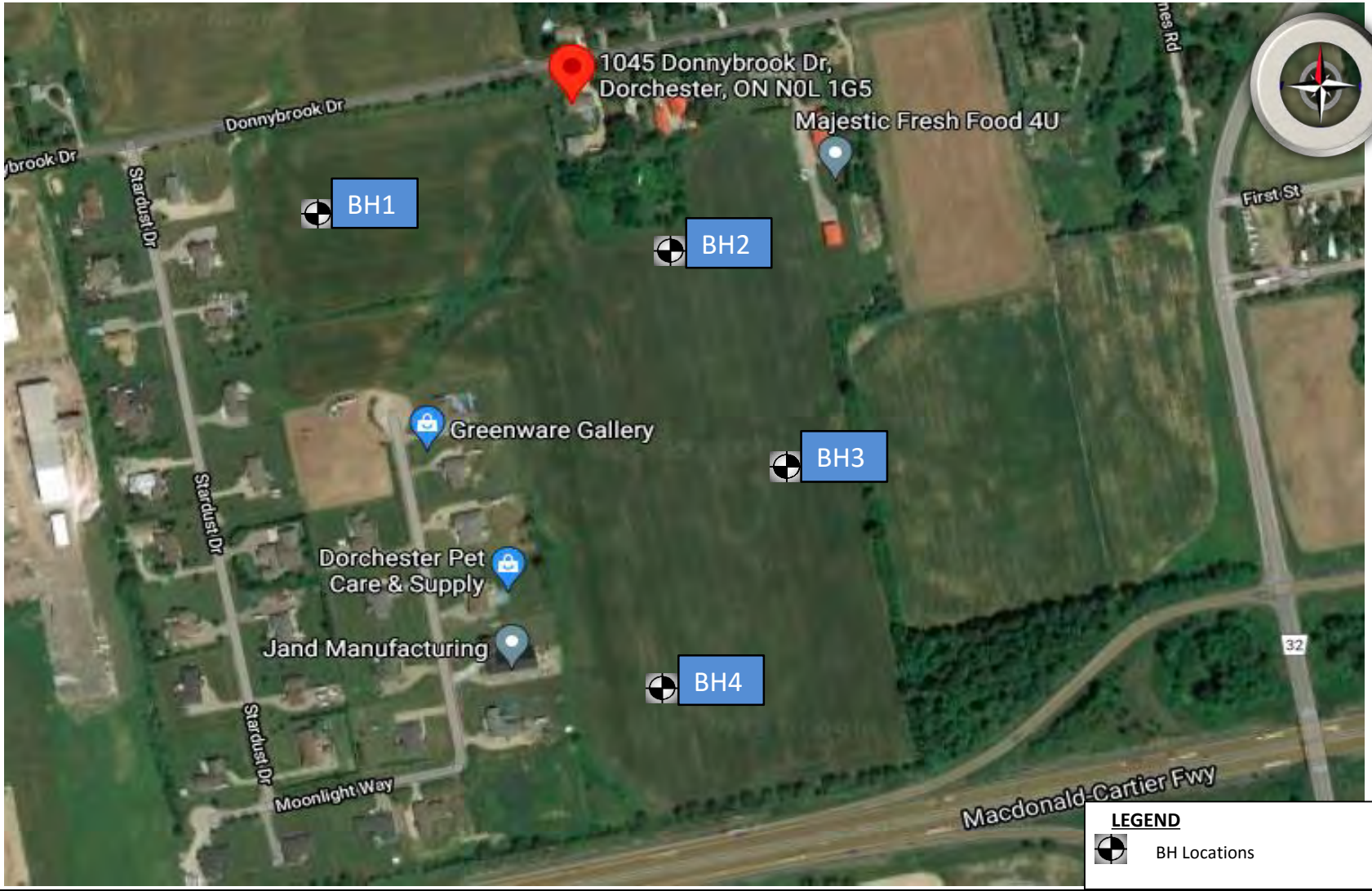
For clarity, the Client acknowledges and accepts that unique risks exist whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. The environmental, geological, geotechnical, geochemical and hydrogeological conditions that Sola Engineering interprets to exist between sampling points may differ from those that actually exist. As a result, the Client acknowledges and accepts that because of the inherent uncertainties in subsurface evaluations, unanticipated underground conditions may occur or become known subsequent to Sola Engineering's investigation that could affect conclusions, recommendations, total Project cost and/or execution.

Indemnification of Risk
Though Sola Engineering adheres to the highest degree of integrity and employs due diligence in limiting the potential release of toxins and hazardous substances, the risk of accidental release of such substances is a possibility when providing geotechnical and environmental services.

In consideration of the provision of services by Sola Engineering, the Client agrees to defend, indemnify and hold Sola Engineering and its employees and agents harmless from and against any and all claims, liabilities, damages, causes of action, judgments, costs or expenses (including reasonable legal fees and disbursements), resulting from or arising by reason of the death or bodily injury to persons, damage to property, or other loss, whether related to an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project or otherwise, and whether or not resulting from Sola Engineering's negligent actions or omissions. This indemnification shall include and extend to any and all third party claims brought or threatened against Sola Engineering under any federal or provincial law or statute as a result of Sola Engineering conducting work on the Project. In addition to and notwithstanding the foregoing, the Client further agrees to unconditionally and irrevocably release Sola Engineering from, and not to bring any claims against Sola Engineering in connection with, any of the aforementioned claims or causes.

Subconsultants and Contractor Services
In conjunction with the services provided by Sola Engineering's own employees, external services provided by other persons or entities that are specializing in services other than those offered by Sola Engineering, such as drilling, excavation and laboratory testing, are often employed in order to carry out the defined scope of work. If such external services have been employed for this Project, the Client acknowledges that Sola Engineering is not in any way liable or responsible for any costs, claims or damages in relation to the services rendered by such other persons or entities or payment therefor, nor shall Sola Engineering be liable or responsible for damages for errors, omissions or negligence caused by such other persons or entities while providing such external services.

Work and Job Site Safety
Sola Engineering shall be responsible only for its activities and that of its employees on the Site. Sola Engineering shall not direct any of the fieldwork nor the work of any other person or entity on the Project. The presence of Sola Engineering staff on the Site does not relieve the Client or any contractor on the Site from their responsibilities pertaining to site safety. The Client at all times retains any and all responsibility for the safety of those individuals present on the Site and/or working on the Project, including Sola Engineering's employees.



SOLA ENGINEERING	File No.: 10826-S0456-GEO	**BH Location Plan**	The figure provided is for the intended purpose of presenting the approximate borehole locations. This figure should not be used for any other purposes including construction, architecture or for accuracy of dimensions and orientation of objects.	Enclosure No.: **1**
	Report Number: 2021-15454	**Proposed Industrial Subdivision**		
		1045 Donnybrook Drive, Dorchester, Ontario		
	Date: May 17, 2021	**Lantern Capital**		Not to Scale

SOLA ENGINEERING

ENCLOSURE No. 2

RECORD OF BOREHOLE No. BH1

1 OF 1

METRIC

PROJECT NUMBER 10826 | LOCATION 1045 Donnybrook Drive, Dorchester, Ontario | ORIGINATED BY RS

DIST _____ HWY _____ | BOREHOLE TYPE Solid Stem Augers | COMPILED BY CC

DATUM _____ | DATE 2021.05.20 - 2021.05.20 | LATITUDE _____ | LONGITUDE _____ | CHECKED BY GH

SOIL PROFILE			SAMPLES									
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Topsoil										
0.1	TOPSOIL - 100 mm thick FILL - clayey silt, trace gravel, trace sand, brown, moist		1	SS	7				○		
0.8	PROBABLE FILL - clayey silt, trace gravel, trace sand, brown, moist		2	SS	24				○		
1.5	CLAYEY SILT TILL - trace gravel, trace sand, occasional inferred cobble and boulder, brown, very stiff to hard, moist		3	SS	32				○		
			4	SS	36				○		
			5	SS	28				○		
			6	SS	21				○		
6.1	SILTY CLAY TILL - trace gravel, grey, very stiff, moist		7	SS	16				○		
6.6	End of Borehole at Targeted Depth; Borehole Was Open and Dry Upon Completion of Drilling; A Groundwater Measurement Was Taken By the Project Hydrogeology Team On May 25, 2021 and was Approximately 4.8 m Below Existing Ground Surface.										

$+^3$, $\times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 3

RECORD OF BOREHOLE No. BH2 1 OF 1 METRIC

PROJECT NUMBER 10826 LOCATION 1045 Donnybrook Drive, Dorchester, Ontario ORIGINATED BY RS

DIST HWY BOREHOLE TYPE Solid Stem Augers COMPILED BY CC

DATUM DATE 2021.05.20 - 2021.05.20 LATITUDE LONGITUDE CHECKED BY GH

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Topsoil TOPSOIL - 100 mm thick										
0.1	FILL - clayey silt, trace gravel, trace sand, brown, moist		1	SS	6				○		
			2	SS	4				○		
1.5	CLAYEY SILT TILL - trace gravel, brown, stiff to very stiff, moist		3	SS	12				○		
			4	SS	20				○		
			5	SS	21				○		
			6	SS	12				○		
6.1	SILTY CLAY TILL - trace gravel, grey, stiff, moist		7	SS	14				○		
6.6	End of Borehole at Targeted Depth; Borehole Was Open and Dry Upon Completion of Drilling; A Groundwater Measurement Was Taken By the Project Hydrogeology Team On May 25, 2021 and was Approximately 1.2 m Below Existing Ground Surface.										

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 4

RECORD OF BOREHOLE No. BH3 1 OF 1 METRIC

PROJECT NUMBER 10826 LOCATION 1045 Donnybrook Drive, Dorchester, Ontario ORIGINATED BY RS

DIST HWY BOREHOLE TYPE Solid Stem Augers COMPILED BY CC

DATUM DATE 2021.05.20 - 2021.05.20 LATITUDE LONGITUDE CHECKED BY GH

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	TOPSOIL - 150 mm thick										
0.2	FILL - silty sand, trace gravel, trace clay, brown, moist		1	SS	5				○		
0.8	FILL - sandy silt, trace gravel, trace clay, pockets of clayey silt, brown, moist		2	SS	10				○		
1.5	CLAYEY SILT - trace gravel, brown, stiff, moist		3	SS	11				○		
2.3	CLAYEY SILT TILL - trace gravel, brown, stiff to very stiff, moist		4	SS	14				○		
			5	SS	20				○		
4.6	SILTY CLAY TILL - trace gravel, brownish grey, very stiff, very moist		6	SS	18				○		
			7	SS	16				○		
6.6	End of Borehole at Targeted Depth; Borehole Was Open and Dry Upon Completion of Drilling; A Groundwater Measurement Was Taken By the Project Hydrogeology Team On May 25, 2021 and was Approximately 4.2 m Below Existing Ground Surface.										

Topsoil

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 5

RECORD OF BOREHOLE No. BH4 1 OF 1 METRIC

PROJECT NUMBER 10826 LOCATION 1045 Donnybrook Drive, Dorchester, Ontario ORIGINATED BY RS

DIST HWY BOREHOLE TYPE Solid Stem Augers COMPILED BY CC

DATUM DATE 2021.05.20 - 2021.05.20 LATITUDE LONGITUDE CHECKED BY GH

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Topsoil										
0.1	TOPSOIL - 75 mm thick FILL - clayey silt, trace gravel, trace sand, brown, moist		1	SS	4				○		
			2	SS	5				○		
1.5	CLAYEY SILT TILL - trace gravel, trace sand, brown, very stiff, moist		3	SS	21				○		
			4	SS	26				○		
			5	SS	26				○		
4.6	SILTY CLAY TILL - trace gravel, grey, stiff to very stiff, moist		6	SS	18				○		
			7	SS	12				○		
6.6	End of Borehole at Targeted Depth; Borehole Was Open and Dry Upon Completion of Drilling; A Groundwater Measurement Was Taken By the Project Hydrogeology Team On May 25, 2021 and was Approximately 3.5 m Below Existing Ground Surface.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

KEY TO SYMBOLS

Enclosure No.: 6

PROJECT NUMBER 10826

PROJECT NAME Proposed Industrial Subdivision

LOCATION 1045 Donnybrook Drive, Dorchester, Ontario

CLIENT Lantern Capital

LITHOLOGIC SYMBOLS (Unified Soil Classification System)


CL-SL: clayey silt


CL-SL-TL: clayey silt till


FILL: TTC Fill (made ground)


SL-CL: silty clay


TOPSOIL: Topsoil/peat/organics

SAMPLER SYMBOLS


Split Spoon Sample

WELL CONSTRUCTION SYMBOLS


Bentonite Seal: 1 pipe group, 1 pipe


Concrete: 1 pipe group, 1 pipe


Filter Pack: 1 pipe group, 1 pipe


Slotted Pipe: 1 pipe group, 1 pipe


Slough at bottom of hole

Notes:

Terms describing RELATIVE DENSITY, based on Standard Penetration Test "N"-Value for COURSE GRAINED soils (major portion retained on No. 200 seive):

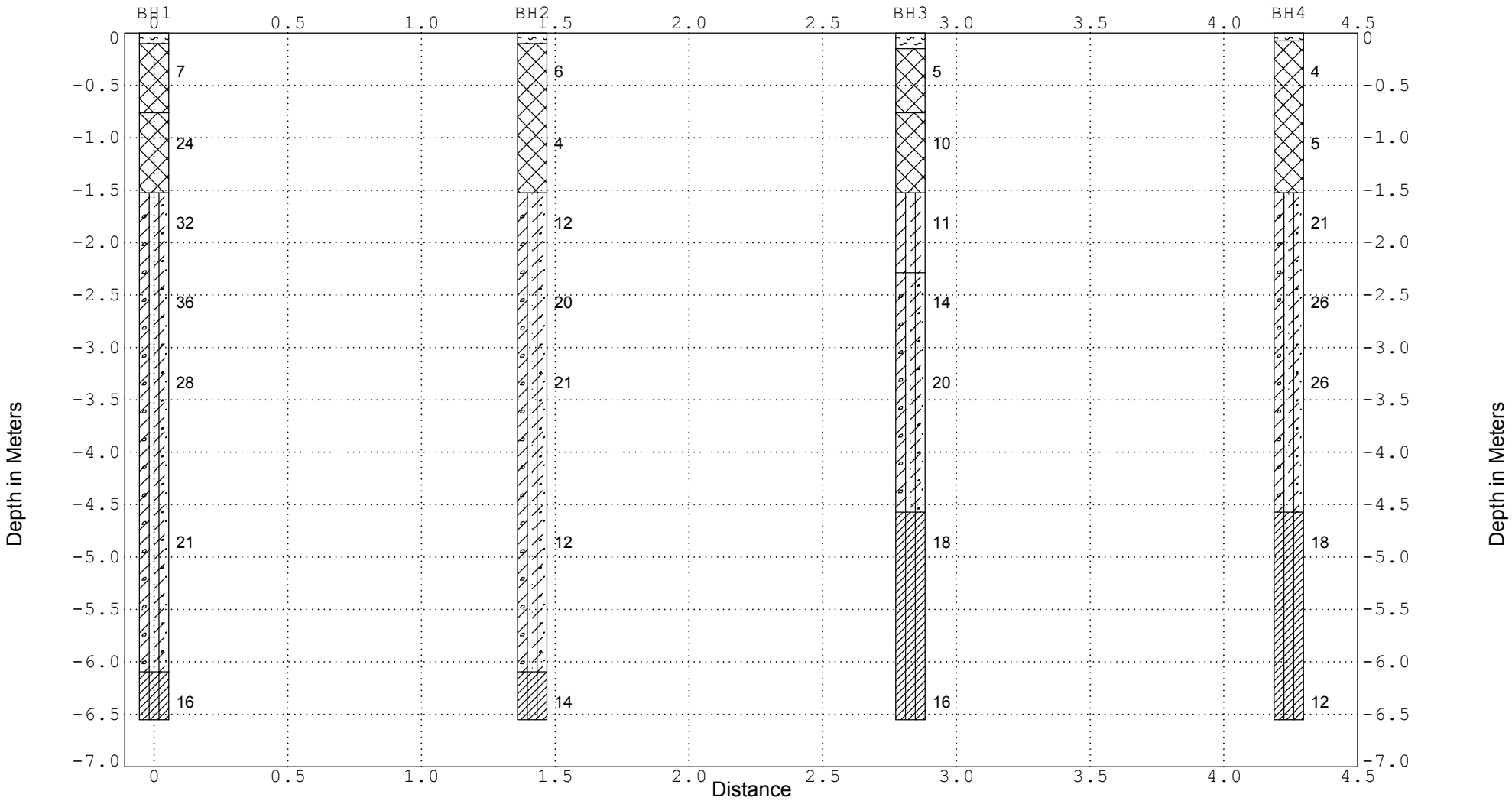
DESCRIPTIVE TERM ["N"-Value (blows/0.3m), Relative Density (%)]

- **Very Loose [less than 4, less than 15]**
- **Loose [4 to 10, 15 to 35]**
- **Compact or Medium [10 to 30, 35 to 65]**
- **Dense [30 to 50, 65 to 85]**
- **Very Dense [greater than 50, greater than 85]**

Terms describing CONSISTENCY, based on Standard Penetration Test "N"-Value for FINE GRAINED soils (major portion passing No. 200 sieve):

DESCRIPTIVE TERM [Unconfined Compressive Strength (kPa), "N"-Value (blows/0.3m)]

- **Very Soft [less than 25, less than 2]**
- **Soft [25 to 50, 2 to 4]**
- **Firm [50 to 100, 4 to 8]**
- **Stiff [100 to 200, 8 to 15]**
- **Very Stiff [200 to 400, 15 to 30]**
- **Hard [greater than 400, greater than 30]**



Plan View

SOLA ENGINEERING

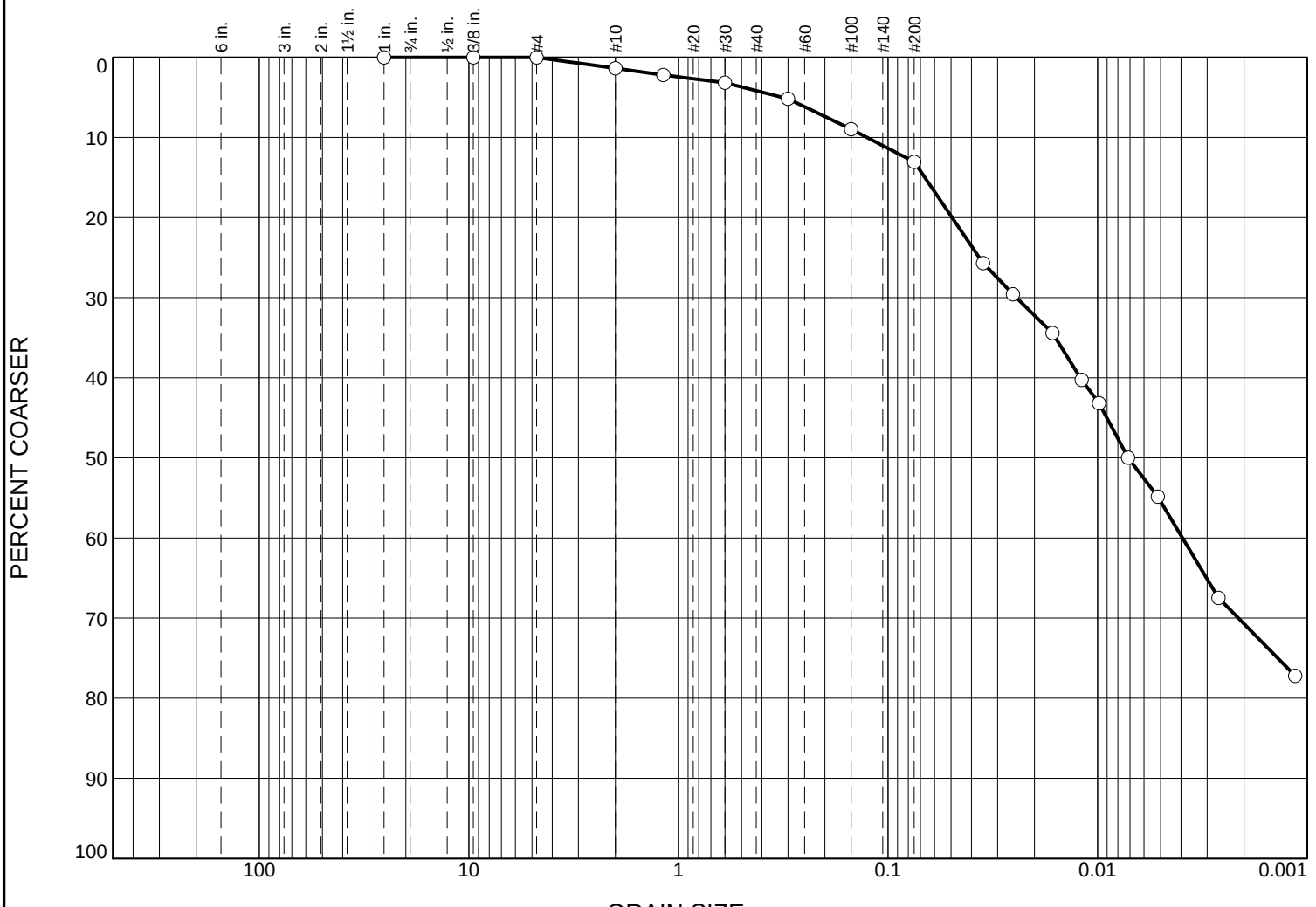
SOLA ENGINEERING INC.
CONCEPTUAL SOIL PROFILE

Horizontal Scale:	Drawn By:	
Vertical Scale:	Approved By:	

Proposed Industrial Subdivision
1045 Donnybrook Drive, Dorchester, Ontario

Project Number: 10826 | Enclosure No.: 7

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0	0	0	1	3	9	87

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.0667	0.0121	0.0071	0.0021				

Material Description	USCS	AASHTO
○ CLAYEY SILT TILL (VISUAL/MANUAL) CLAYEY SILT (LAB)		

Project No. 10826 **Client:** Lantern Capital

Project: Proposed Industrial Subdivision

○ **Location:** BH1 SS4 **Sample Number:** 21-204

Date: ○

Remarks:

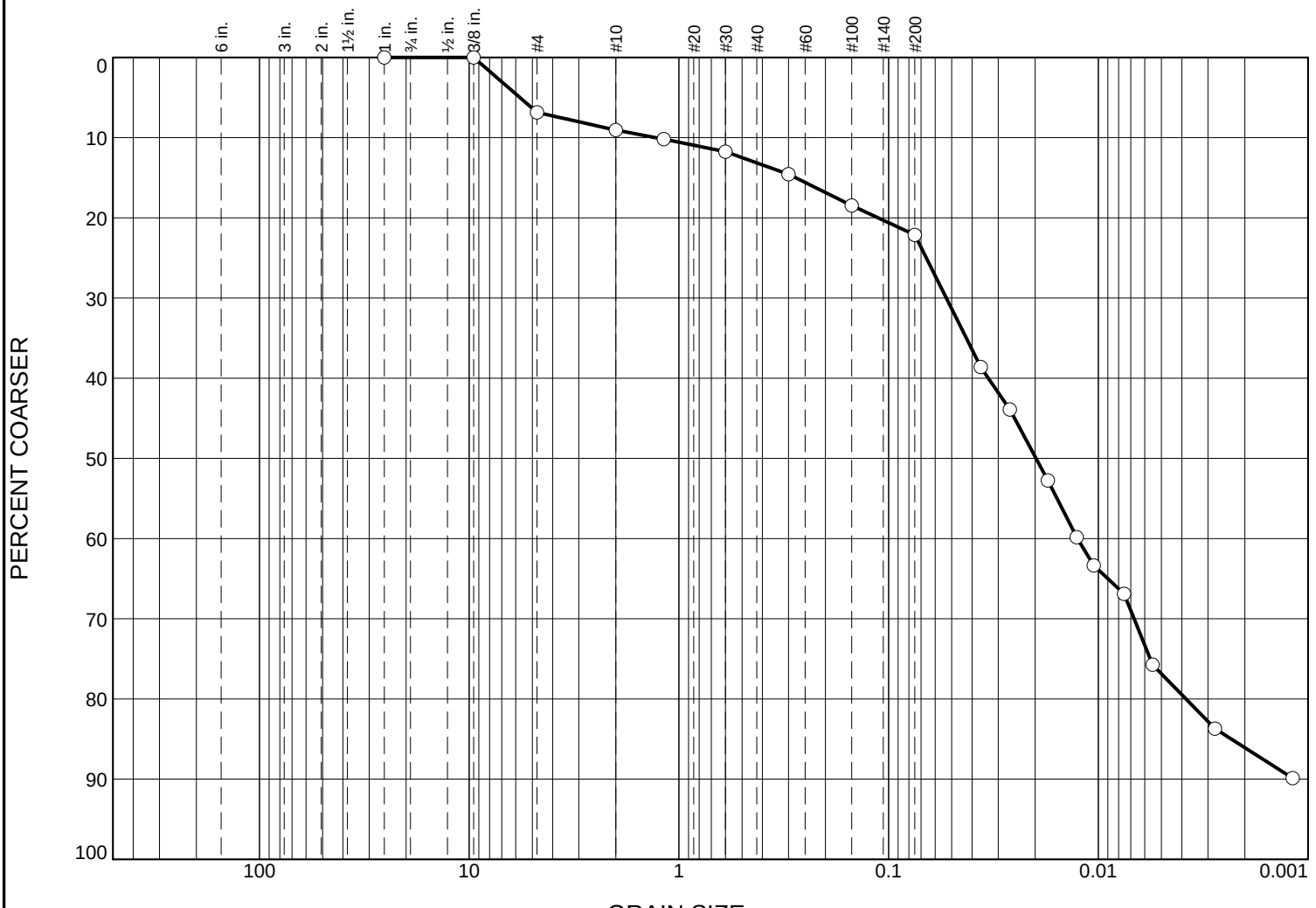
○ Smapled By: Rattan

Date: May 20, 2021

Note: Additional Information is available upon request

SOLA ENGINEERING INC.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0	0	7	2	4	9	78

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○				0.2777	0.0334	0.0198	0.0068	0.0023			

Material Description	USCS	AASHTO
○ CLAYEY SILT TILL (VISUAL/MANUAL) CLAYEY SILT WITH SAND (LAB)		

Project No. 10826 **Client:** Lantern Capital

Project: Proposed Industrial Subdivision

○ **Location:** BH4 SS5 **Sample Number:** 21-203

Date: ○

Remarks:

○ Smapled By: Rattan

Date: May 20, 2021

Note: Additional Information is available upon request

SOLA ENGINEERING INC.

Appendix D

Pre-Development Conditions Hydrologic Modelling Output

```
================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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  Output  filename:
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1051999-4627-463f-9b31-a7df4e18b269\
  Summary filename:
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1051999-4627-463f-9b31-a7df4e18b269\


DATE: 11/15/2021                          TIME: 04:33:25

USER:


COMMENTS: Catchment Drains to Newton-Capstick Municipal Drain


--------------------------------------------------------------------------------
----------------------
  ************************************************
  ** SIMULATION : 100-year Storm                 **
  ************************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2619.363
| Ptotal= 79.37 mm |                          B=  10.500
--------------------                          C=   0.884
                       used in:   INTENSITY =  A / (t + B)^C
```

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.30	1.08	23.09	2.08	12.82	3.08	4.80
0.17	3.56	1.17	38.91	2.17	11.32	3.17	4.56
0.25	3.86	1.25	92.77	2.25	10.11	3.25	4.34
0.33	4.23	1.33	232.24	2.33	9.13	3.33	4.14
0.42	4.67	1.42	118.26	2.42	8.32	3.42	3.95
0.50	5.21	1.50	67.39	2.50	7.63	3.50	3.79
0.58	5.89	1.58	45.00	2.58	7.04	3.58	3.63
0.67	6.78	1.67	32.92	2.67	6.54	3.67	3.49
0.75	7.96	1.75	25.56	2.75	6.10	3.75	3.36
0.83	9.61	1.83	20.68	2.83	5.71	3.83	3.24
0.92	12.05	1.92	17.26	2.92	5.37	3.92	3.13
1.00	15.97	2.00	14.74	3.00	5.07	4.00	3.02

CALIB			
NASHYD (0001)	Area (ha)= 9.60	Curve Number (CN)= 83.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.69		

Unit Hyd Qpeak (cms)= 0.531

PEAK FLOW (cms)= 0.658 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 43.762
TOTAL RAINFALL (mm)= 79.374
RUNOFF COEFFICIENT = 0.551

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
V    V   I    SSSSS  U   U    A    L             (v 6.2.2006)
V    V   I    SS     U   U   A A   L
 V  V    I     SS    U   U  AAAAA  L
 V  V    I      SS   U   U  A   A  L
  VV     I    SSSSS  UUUUU  A   A  LLLLL

 OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
O   O    T      T    H   H   Y Y   MM MM  O   O
O   O    T      T    H   H    Y    M   M  O   O
```

```
       OOO     T      T    H   H    Y    M   M   OOO
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```


```
                  *****  D E T A I L E D   O U T P U T *****


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DATE: 11/15/2021                          TIME: 04:33:25

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
-----------------------
  ********************************************
  ** SIMULATION : 10-year Storm               **
  ********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1574.382
| Ptotal= 54.75 mm |                          B=   9.025
--------------------                          C=   0.860
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.08    2.53 |  1.08   15.60 |  2.08    8.95 |  3.08    3.58
                0.17    2.71 |  1.17   25.83 |  2.17    7.96 |  3.17    3.41
                0.25    2.93 |  1.25   61.71 |  2.25    7.17 |  3.25    3.26
                0.33    3.19 |  1.33  162.47 |  2.33    6.51 |  3.33    3.12
                0.42    3.49 |  1.42   79.04 |  2.42    5.97 |  3.42    2.99
```

```
                0.50    3.87 |  1.50   44.47 |  2.50    5.51 |  3.50    2.88
                0.58    4.34 |  1.58   29.77 |  2.58    5.12 |  3.58    2.77
                0.67    4.94 |  1.67   21.95 |  2.67    4.77 |  3.67    2.67
                0.75    5.73 |  1.75   17.20 |  2.75    4.47 |  3.75    2.57
                0.83    6.83 |  1.83   14.05 |  2.83    4.21 |  3.83    2.49
                0.92    8.44 |  1.92   11.83 |  2.92    3.98 |  3.92    2.41
                1.00   11.00 |  2.00   10.20 |  3.00    3.77 |  4.00    2.33


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   9.60   Curve Number   (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.69

     Unit Hyd Qpeak  (cms)=   0.531

     PEAK FLOW       (cms)=   0.351 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  24.317
     TOTAL RAINFALL   (mm)=  54.748
     RUNOFF COEFFICIENT   =   0.444

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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DATE: 11/15/2021 TIME: 04:33:25

USER:

COMMENTS: _____

****
** SIMULATION : 25-year Storm **
****

| CHICAGO STORM |
| Ptotal= 64.46 mm |

IDF curve parameters: A=2019.372
B= 9.824
C= 0.875
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.78	1.08	18.53	2.08	10.41	3.08	4.00
0.17	2.99	1.17	31.05	2.17	9.22	3.17	3.81
0.25	3.24	1.25	74.37	2.25	8.27	3.25	3.63
0.33	3.54	1.33	190.82	2.33	7.48	3.33	3.47
0.42	3.90	1.42	95.08	2.42	6.83	3.42	3.32
0.50	4.34	1.50	53.76	2.50	6.28	3.50	3.18
0.58	4.89	1.58	35.88	2.58	5.81	3.58	3.06
0.67	5.60	1.67	26.31	2.67	5.41	3.67	2.94
0.75	6.54	1.75	20.49	2.75	5.05	3.75	2.83
0.83	7.86	1.83	16.63	2.83	4.74	3.83	2.74
0.92	9.80	1.92	13.93	2.92	4.47	3.92	2.64
1.00	12.91	2.00	11.93	3.00	4.22	4.00	2.56

| CALIB |

```
| NASHYD   (  0001)|   Area    (ha)=   9.60   Curve Number   (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   0.69

     Unit Hyd Qpeak  (cms)=   0.531

     PEAK FLOW       (cms)=   0.468 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  31.715
     TOTAL RAINFALL   (mm)=  64.464
     RUNOFF COEFFICIENT   =   0.492

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\0
d634577-eb90-4aa0-bdb9-11806d26dce1\
  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\0
d634577-eb90-4aa0-bdb9-11806d26dce1\


DATE: 11/15/2021                          TIME: 04:33:25

USER:
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COMMENTS: _____

```
  **********************************************
  ** SIMULATION : 2-year                       **
  **********************************************
```

CHICAGO STORM	Ptotal= 44.94 mm

IDF curve parameters: A=1290.000
B= 8.500
C= 0.860
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.05	1.08	12.57	2.08	7.21	3.08	2.90
0.17	2.20	1.17	20.86	2.17	6.42	3.17	2.77
0.25	2.38	1.25	50.59	2.25	5.78	3.25	2.64
0.33	2.58	1.33	137.56	2.33	5.26	3.33	2.53
0.42	2.83	1.42	65.09	2.42	4.82	3.42	2.43
0.50	3.13	1.50	36.14	2.50	4.45	3.50	2.33
0.58	3.51	1.58	24.07	2.58	4.14	3.58	2.25
0.67	3.99	1.67	17.71	2.67	3.86	3.67	2.17
0.75	4.63	1.75	13.86	2.75	3.62	3.75	2.09
0.83	5.51	1.83	11.32	2.83	3.41	3.83	2.02
0.92	6.81	1.92	9.54	2.92	3.22	3.92	1.96
1.00	8.86	2.00	8.22	3.00	3.05	4.00	1.89

CALIB NASHYD (0001) ID= 1 DT= 5.0 min	Area (ha)= 9.60	Curve Number (CN)= 83.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.69	

Unit Hyd Qpeak (cms)= 0.531

PEAK FLOW (cms)= 0.247 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 17.346
TOTAL RAINFALL (mm)= 44.941
RUNOFF COEFFICIENT = 0.386

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
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Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\dd9361e4-2d5a-44d1-b636-1968ca914566\

DATE: 11/15/2021 TIME: 04:33:25

USER:

COMMENTS: _____


```
  **********************************************
  ** SIMULATION : 50-year Storm                **
  **********************************************
```

| CHICAGO STORM | IDF curve parameters: A=2270.665

```
| Ptotal= 72.05 mm |                          B=   9.984
--------------------                          C=   0.876
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.10	1.08	20.80	2.08	11.67	3.08	4.47
0.17	3.34	1.17	34.86	2.17	10.33	3.17	4.25
0.25	3.62	1.25	83.24	2.25	9.26	3.25	4.05
0.33	3.95	1.33	211.98	2.33	8.38	3.33	3.87
0.42	4.35	1.42	106.30	2.42	7.64	3.42	3.70
0.50	4.85	1.50	60.28	2.50	7.03	3.50	3.55
0.58	5.47	1.58	40.27	2.58	6.50	3.58	3.41
0.67	6.26	1.67	29.53	2.67	6.04	3.67	3.28
0.75	7.32	1.75	22.99	2.75	5.65	3.75	3.16
0.83	8.80	1.83	18.66	2.83	5.30	3.83	3.05
0.92	10.98	1.92	15.62	2.92	4.99	3.92	2.95
1.00	14.48	2.00	13.38	3.00	4.72	4.00	2.85

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   9.60   Curve Number   (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.69

     Unit Hyd Qpeak  (cms)=   0.531

     PEAK FLOW       (cms)=   0.561 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  37.752
     TOTAL RAINFALL   (mm)=  72.046
     RUNOFF COEFFICIENT   =   0.524

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2006)
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       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
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Summary filename:
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DATE: 11/15/2021 TIME: 04:33:25

USER:

COMMENTS: _____

****
** SIMULATION : 5-year Storm **
****

| CHICAGO STORM | Ptotal= 46.69 mm |

IDF curve parameters: A=1183.740
B= 7.641
C= 0.838
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.36	1.08	13.04	2.08	7.70	3.08	3.27
0.17	2.52	1.17	21.19	2.17	6.90	3.17	3.12
0.25	2.71	1.25	50.66	2.25	6.25	3.25	2.99
0.33	2.93	1.33	141.24	2.33	5.72	3.33	2.87
0.42	3.19	1.42	65.17	2.42	5.27	3.42	2.76
0.50	3.51	1.50	36.21	2.50	4.89	3.50	2.66
0.58	3.91	1.58	24.34	2.58	4.56	3.58	2.56
0.67	4.41	1.67	18.09	2.67	4.27	3.67	2.48
0.75	5.07	1.75	14.31	2.75	4.02	3.75	2.40
0.83	5.98	1.83	11.80	2.83	3.80	3.83	2.32
0.92	7.29	1.92	10.03	2.92	3.60	3.92	2.25
1.00	9.36	2.00	8.71	3.00	3.43	4.00	2.18

CALIB			
NASHYD (0001)	Area (ha)= 9.60	Curve Number (CN)= 83.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.69		

Unit Hyd Qpeak (cms)= 0.531

PEAK FLOW (cms)= 0.259 (i)
TIME TO PEAK (hrs)= 2.250
RUNOFF VOLUME (mm)= 18.549
TOTAL RAINFALL (mm)= 46.694
RUNOFF COEFFICIENT = 0.397

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\6
a32d773-f0e7-41d2-8281-1cd184b1116f\


DATE: 11/15/2021                          TIME: 04:34:44

USER:


COMMENTS: Catchment Drains to Rath Harris Municipal Drain

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  ************************************************
  ** SIMULATION : 100-year Storm                 **
  ************************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2619.363
| Ptotal= 79.37 mm |                          B=  10.500
--------------------                          C=   0.884
                       used in:   INTENSITY =  A / (t + B)^C
```

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.30	1.08	23.09	2.08	12.82	3.08	4.80
0.17	3.56	1.17	38.91	2.17	11.32	3.17	4.56
0.25	3.86	1.25	92.77	2.25	10.11	3.25	4.34
0.33	4.23	1.33	232.24	2.33	9.13	3.33	4.14
0.42	4.67	1.42	118.26	2.42	8.32	3.42	3.95
0.50	5.21	1.50	67.39	2.50	7.63	3.50	3.79
0.58	5.89	1.58	45.00	2.58	7.04	3.58	3.63
0.67	6.78	1.67	32.92	2.67	6.54	3.67	3.49
0.75	7.96	1.75	25.56	2.75	6.10	3.75	3.36
0.83	9.61	1.83	20.68	2.83	5.71	3.83	3.24
0.92	12.05	1.92	17.26	2.92	5.37	3.92	3.13
1.00	15.97	2.00	14.74	3.00	5.07	4.00	3.02

CALIB			
NASHYD (0001)	Area (ha)= 12.57	Curve Number (CN)= 83.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.70		

Unit Hyd Qpeak (cms)= 0.686

PEAK FLOW (cms)= 0.852 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 43.762
TOTAL RAINFALL (mm)= 79.374
RUNOFF COEFFICIENT = 0.551

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
       V    V   I    SSSSS  U   U    A    L             (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
```

```
       OOO     T      T    H   H    Y    M   M   OOO
```
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\3c55f286-a31c-40a0-8d3e-3c872bd0c6b9\
Summary filename:
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DATE: 11/15/2021 TIME: 04:34:44

USER:

COMMENTS: _____

****
** SIMULATION : 10-year Storm **
****

| CHICAGO STORM |
| Ptotal= 54.75 mm |

IDF curve parameters: A=1574.382
B= 9.025
C= 0.860
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.53	1.08	15.60	2.08	8.95	3.08	3.58
0.17	2.71	1.17	25.83	2.17	7.96	3.17	3.41
0.25	2.93	1.25	61.71	2.25	7.17	3.25	3.26
0.33	3.19	1.33	162.47	2.33	6.51	3.33	3.12
0.42	3.49	1.42	79.04	2.42	5.97	3.42	2.99

```
                0.50    3.87 |  1.50   44.47 |  2.50    5.51 |  3.50    2.88
                0.58    4.34 |  1.58   29.77 |  2.58    5.12 |  3.58    2.77
                0.67    4.94 |  1.67   21.95 |  2.67    4.77 |  3.67    2.67
                0.75    5.73 |  1.75   17.20 |  2.75    4.47 |  3.75    2.57
                0.83    6.83 |  1.83   14.05 |  2.83    4.21 |  3.83    2.49
                0.92    8.44 |  1.92   11.83 |  2.92    3.98 |  3.92    2.41
                1.00   11.00 |  2.00   10.20 |  3.00    3.77 |  4.00    2.33


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  12.57   Curve Number   (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.70

     Unit Hyd Qpeak  (cms)=   0.686

     PEAK FLOW       (cms)=   0.454 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  24.317
     TOTAL RAINFALL   (mm)=  54.748
     RUNOFF COEFFICIENT   =   0.444

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\b144cf04-12f5-49d8-acff-9bf35c710077\

DATE: 11/15/2021 TIME: 04:34:45

USER:

COMMENTS: _____

****
** SIMULATION : 25-year Storm **
****

| CHICAGO STORM |
| Ptotal= 64.46 mm |

IDF curve parameters: A=2019.372
B= 9.824
C= 0.875
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.78	1.08	18.53	2.08	10.41	3.08	4.00
0.17	2.99	1.17	31.05	2.17	9.22	3.17	3.81
0.25	3.24	1.25	74.37	2.25	8.27	3.25	3.63
0.33	3.54	1.33	190.82	2.33	7.48	3.33	3.47
0.42	3.90	1.42	95.08	2.42	6.83	3.42	3.32
0.50	4.34	1.50	53.76	2.50	6.28	3.50	3.18
0.58	4.89	1.58	35.88	2.58	5.81	3.58	3.06
0.67	5.60	1.67	26.31	2.67	5.41	3.67	2.94
0.75	6.54	1.75	20.49	2.75	5.05	3.75	2.83
0.83	7.86	1.83	16.63	2.83	4.74	3.83	2.74
0.92	9.80	1.92	13.93	2.92	4.47	3.92	2.64
1.00	12.91	2.00	11.93	3.00	4.22	4.00	2.56

| CALIB |

```
| NASHYD   (  0001)|   Area    (ha)=  12.57   Curve Number   (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   0.70

     Unit Hyd Qpeak  (cms)=   0.686

     PEAK FLOW       (cms)=   0.607 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  31.715
     TOTAL RAINFALL   (mm)=  64.464
     RUNOFF COEFFICIENT   =   0.492

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\b
e041554-c368-4169-9e63-a59621c3e529\
  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\b
e041554-c368-4169-9e63-a59621c3e529\


DATE: 11/15/2021                          TIME: 04:34:45

USER:
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COMMENTS: _____

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  **********************************************
  ** SIMULATION : 2-year                       **
  **********************************************
```

CHICAGO STORM	Ptotal= 44.94 mm

IDF curve parameters: A=1290.000
B= 8.500
C= 0.860
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.05	1.08	12.57	2.08	7.21	3.08	2.90
0.17	2.20	1.17	20.86	2.17	6.42	3.17	2.77
0.25	2.38	1.25	50.59	2.25	5.78	3.25	2.64
0.33	2.58	1.33	137.56	2.33	5.26	3.33	2.53
0.42	2.83	1.42	65.09	2.42	4.82	3.42	2.43
0.50	3.13	1.50	36.14	2.50	4.45	3.50	2.33
0.58	3.51	1.58	24.07	2.58	4.14	3.58	2.25
0.67	3.99	1.67	17.71	2.67	3.86	3.67	2.17
0.75	4.63	1.75	13.86	2.75	3.62	3.75	2.09
0.83	5.51	1.83	11.32	2.83	3.41	3.83	2.02
0.92	6.81	1.92	9.54	2.92	3.22	3.92	1.96
1.00	8.86	2.00	8.22	3.00	3.05	4.00	1.89

CALIB NASHYD (0001) | ID= 1 DT= 5.0 min	Area (ha)= 12.57	Curve Number (CN)= 83.0
	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.70	

Unit Hyd Qpeak (cms)= 0.686

PEAK FLOW (cms)= 0.321 (i)
TIME TO PEAK (hrs)= 2.250
RUNOFF VOLUME (mm)= 17.346
TOTAL RAINFALL (mm)= 44.941
RUNOFF COEFFICIENT = 0.386

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

FINISH

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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
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Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\98ebb25a-b2dd-408b-b2d9-9a993c03e5b8\

DATE: 11/15/2021 TIME: 04:34:45

USER:

COMMENTS: _____

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```
  ** SIMULATION : 50-year Storm                 **
  ***********************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2270.665
| Ptotal= 72.05 mm |                          B=   9.984
--------------------                          C=   0.876
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    =  5.00 min
                         Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.08    3.10 |  1.08   20.80 |  2.08   11.67 |  3.08    4.47
                0.17    3.34 |  1.17   34.86 |  2.17   10.33 |  3.17    4.25
                0.25    3.62 |  1.25   83.24 |  2.25    9.26 |  3.25    4.05
                0.33    3.95 |  1.33  211.98 |  2.33    8.38 |  3.33    3.87
                0.42    4.35 |  1.42  106.30 |  2.42    7.64 |  3.42    3.70
                0.50    4.85 |  1.50   60.28 |  2.50    7.03 |  3.50    3.55
                0.58    5.47 |  1.58   40.27 |  2.58    6.50 |  3.58    3.41
                0.67    6.26 |  1.67   29.53 |  2.67    6.04 |  3.67    3.28
                0.75    7.32 |  1.75   22.99 |  2.75    5.65 |  3.75    3.16
                0.83    8.80 |  1.83   18.66 |  2.83    5.30 |  3.83    3.05
                0.92   10.98 |  1.92   15.62 |  2.92    4.99 |  3.92    2.95
                1.00   14.48 |  2.00   13.38 |  3.00    4.72 |  4.00    2.85


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--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=  12.57   Curve Number   (CN)= 83.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.70

     Unit Hyd Qpeak  (cms)=   0.686

     PEAK FLOW       (cms)=   0.727 (i)
     TIME TO PEAK    (hrs)=   2.167
     RUNOFF VOLUME    (mm)=  37.752
     TOTAL RAINFALL   (mm)=  72.046
     RUNOFF COEFFICIENT   =   0.524

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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       V    V   I    SSSSS  U   U    A    L             (v 6.2.2006)
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```
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
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Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\1b577058-7d3f-49c1-87b7-1dcbb0c25077\

DATE: 11/15/2021 TIME: 04:34:44

USER:

COMMENTS: _____

****
** SIMULATION : 5-year Storm **
****

| CHICAGO STORM | Ptotal= 46.69 mm |

IDF curve parameters: A=1183.740
B= 7.641
C= 0.838
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.36	1.08	13.04	2.08	7.70	3.08	3.27
0.17	2.52	1.17	21.19	2.17	6.90	3.17	3.12
0.25	2.71	1.25	50.66	2.25	6.25	3.25	2.99
0.33	2.93	1.33	141.24	2.33	5.72	3.33	2.87
0.42	3.19	1.42	65.17	2.42	5.27	3.42	2.76
0.50	3.51	1.50	36.21	2.50	4.89	3.50	2.66
0.58	3.91	1.58	24.34	2.58	4.56	3.58	2.56
0.67	4.41	1.67	18.09	2.67	4.27	3.67	2.48
0.75	5.07	1.75	14.31	2.75	4.02	3.75	2.40
0.83	5.98	1.83	11.80	2.83	3.80	3.83	2.32
0.92	7.29	1.92	10.03	2.92	3.60	3.92	2.25
1.00	9.36	2.00	8.71	3.00	3.43	4.00	2.18

CALIB			
NASHYD (0001)	Area (ha)= 12.57	Curve Number (CN)= 83.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.70		

Unit Hyd Qpeak (cms)= 0.686

PEAK FLOW (cms)= 0.336 (i)
TIME TO PEAK (hrs)= 2.250
RUNOFF VOLUME (mm)= 18.549
TOTAL RAINFALL (mm)= 46.694
RUNOFF COEFFICIENT = 0.397

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

Appendix E

Post-Development Conditions Hydrologic Modelling Output

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\0
1aa7571-04a3-4e5b-b591-c4765341a3ee\


DATE: 11/18/2021                          TIME: 10:54:39

USER:



COMMENTS: _____________________________________________________________


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  ***********************************************
  ** SIMULATION : 100-year Storm                **
  ***********************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2619.363
| Ptotal= 79.37 mm |                          B=  10.500
--------------------                          C=   0.884
                       used in:   INTENSITY =  A / (t + B)^C
```

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.30	1.08	23.09	2.08	12.82	3.08	4.80
0.17	3.56	1.17	38.91	2.17	11.32	3.17	4.56
0.25	3.86	1.25	92.77	2.25	10.11	3.25	4.34
0.33	4.23	1.33	232.24	2.33	9.13	3.33	4.14
0.42	4.67	1.42	118.26	2.42	8.32	3.42	3.95
0.50	5.21	1.50	67.39	2.50	7.63	3.50	3.79
0.58	5.89	1.58	45.00	2.58	7.04	3.58	3.63
0.67	6.78	1.67	32.92	2.67	6.54	3.67	3.49
0.75	7.96	1.75	25.56	2.75	6.10	3.75	3.36
0.83	9.61	1.83	20.68	2.83	5.71	3.83	3.24
0.92	12.05	1.92	17.26	2.92	5.37	3.92	3.13
1.00	15.97	2.00	14.74	3.00	5.07	4.00	3.02

CALIB			
NASHYD (0002)	Area (ha)=	1.50	Curve Number (CN)= 88.0
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)=	0.12	

Unit Hyd Qpeak (cms)= 0.477

PEAK FLOW (cms)= 0.371 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 50.065
TOTAL RAINFALL (mm)= 79.374
RUNOFF COEFFICIENT = 0.631

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
STANDHYD (0001)	Area (ha)=	20.71	
ID= 1 DT= 3.0 min	Total Imp(%)=	85.00	Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	17.60	3.11
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	371.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.050	3.30	1.050	23.09	2.050	12.82	3.05	4.80
0.100	3.38	1.100	28.36	2.100	12.32	3.10	4.72
0.150	3.56	1.150	38.91	2.150	11.32	3.15	4.56
0.200	3.76	1.200	74.81	2.200	10.52	3.20	4.41
0.250	3.86	1.250	92.77	2.250	10.11	3.25	4.34
0.300	4.23	1.300	232.24	2.300	9.13	3.30	4.14
0.350	4.38	1.350	194.25	2.350	8.86	3.35	4.07
0.400	4.67	1.400	118.26	2.400	8.32	3.40	3.95
0.450	5.03	1.450	84.35	2.450	7.86	3.45	3.84
0.500	5.21	1.500	67.39	2.500	7.63	3.50	3.79
0.550	5.89	1.550	45.00	2.550	7.04	3.55	3.63
0.600	6.19	1.600	40.98	2.600	6.87	3.60	3.59
0.650	6.78	1.650	32.92	2.650	6.54	3.65	3.49
0.700	7.56	1.700	28.01	2.700	6.24	3.70	3.40
0.750	7.96	1.750	25.56	2.750	6.10	3.75	3.36
0.800	9.61	1.800	20.68	2.800	5.71	3.80	3.24
0.850	10.42	1.850	19.54	2.850	5.60	3.85	3.20
0.900	12.05	1.900	17.26	2.900	5.37	3.90	3.13
0.950	14.66	1.950	15.58	2.950	5.17	3.95	3.06
1.000	15.97	2.000	14.74	3.000	5.07	4.00	3.02

Max.Eff.Inten.(mm/hr)=	213.25	********		
over (min)	6.00	9.00		
Storage Coeff. (min)=	4.15 (ii)	6.89 (ii)		
Unit Hyd. Tpeak (min)=	6.00	9.00		
Unit Hyd. peak (cms)=	0.23	0.15		
			TOTALS	
PEAK FLOW (cms)=	7.06	1.10	8.038 (iii)	
TIME TO PEAK (hrs)=	1.40	1.45	1.40	
RUNOFF VOLUME (mm)=	77.37	44.90	69.25	
TOTAL RAINFALL (mm)=	79.37	79.37	79.37	
RUNOFF COEFFICIENT =	0.97	0.57	0.87	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0006)				
1 + 2 = 3	AREA	QPEAK	TPEAK	R.V.

```
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    20.71   8.038     1.40    69.25
      + ID2= 2 (  0002):     1.50   0.371     1.42    50.07
        ================================================
        ID = 3 (  0006):    22.21   8.390     1.40    67.95

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                    AREA     QPEAK     TPEAK       R.V.
                                    (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      8.390      1.40      67.95
   OUTFLOW: ID= 1 (  0004)     22.210      0.656      2.25      67.90

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.82
                  TIME SHIFT OF PEAK FLOW         (min)= 51.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.1166

------------------------------------------------------------------------------
==============================================================================
======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
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Output filename:
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Summary filename:
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DATE: 11/18/2021 TIME: 10:54:40

USER:

COMMENTS: _____

****
** SIMULATION : 100-year-24 hours **
****

| CHICAGO STORM |
| Ptotal=100.84 mm |

IDF curve parameters: A=2619.363
B= 10.500
C= 0.884
used in: INTENSITY = A / (t + B)^C

Duration of storm = 24.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.52	6.08	2.08	12.08	1.93	18.08	0.79		
0.17	0.52	6.17	2.18	12.17	1.89	18.17	0.79		
0.25	0.53	6.25	2.29	12.25	1.86	18.25	0.78		
0.33	0.54	6.33	2.41	12.33	1.82	18.33	0.78		
0.42	0.54	6.42	2.55	12.42	1.78	18.42	0.77		
0.50	0.55	6.50	2.70	12.50	1.75	18.50	0.76		
0.58	0.55	6.58	2.87	12.58	1.72	18.58	0.76		
0.67	0.56	6.67	3.07	12.67	1.69	18.67	0.75		
0.75	0.56	6.75	3.30	12.75	1.66	18.75	0.75		
0.83	0.57	6.83	3.56	12.83	1.63	18.83	0.74		
0.92	0.58	6.92	3.86	12.92	1.60	18.92	0.74		
1.00	0.58	7.00	4.23	13.00	1.57	19.00	0.73		
1.08	0.59	7.08	4.67	13.08	1.55	19.08	0.73		
1.17	0.60	7.17	5.21	13.17	1.52	19.17	0.72		
1.25	0.60	7.25	5.89	13.25	1.50	19.25	0.72		
1.33	0.61	7.33	6.78	13.33	1.48	19.33	0.71		

1.42	0.62	7.42	7.96	13.42	1.45	19.42	0.71
1.50	0.63	7.50	9.61	13.50	1.43	19.50	0.70
1.58	0.63	7.58	12.05	13.58	1.41	19.58	0.70
1.67	0.64	7.67	15.97	13.67	1.39	19.67	0.69
1.75	0.65	7.75	23.09	13.75	1.37	19.75	0.69
1.83	0.66	7.83	38.91	13.83	1.35	19.83	0.68
1.92	0.67	7.92	92.77	13.92	1.33	19.92	0.68
2.00	0.67	8.00	232.24	14.00	1.31	20.00	0.67
2.08	0.68	8.08	118.26	14.08	1.29	20.08	0.67
2.17	0.69	8.17	67.39	14.17	1.28	20.17	0.66
2.25	0.70	8.25	45.00	14.25	1.26	20.25	0.66
2.33	0.71	8.33	32.92	14.33	1.24	20.33	0.66
2.42	0.72	8.42	25.56	14.42	1.23	20.42	0.65
2.50	0.73	8.50	20.68	14.50	1.21	20.50	0.65
2.58	0.74	8.58	17.26	14.58	1.20	20.58	0.64
2.67	0.75	8.67	14.74	14.67	1.18	20.67	0.64
2.75	0.77	8.75	12.82	14.75	1.17	20.75	0.64
2.83	0.78	8.83	11.32	14.83	1.15	20.83	0.63
2.92	0.79	8.92	10.11	14.92	1.14	20.92	0.63
3.00	0.80	9.00	9.13	15.00	1.13	21.00	0.62
3.08	0.81	9.08	8.32	15.08	1.11	21.08	0.62
3.17	0.83	9.17	7.63	15.17	1.10	21.17	0.62
3.25	0.84	9.25	7.04	15.25	1.09	21.25	0.61
3.33	0.86	9.33	6.54	15.33	1.08	21.33	0.61
3.42	0.87	9.42	6.10	15.42	1.07	21.42	0.61
3.50	0.89	9.50	5.71	15.50	1.05	21.50	0.60
3.58	0.90	9.58	5.37	15.58	1.04	21.58	0.60
3.67	0.92	9.67	5.07	15.67	1.03	21.67	0.60
3.75	0.94	9.75	4.80	15.75	1.02	21.75	0.59
3.83	0.96	9.83	4.56	15.83	1.01	21.83	0.59
3.92	0.97	9.92	4.34	15.92	1.00	21.92	0.59
4.00	0.99	10.00	4.14	16.00	0.99	22.00	0.58
4.08	1.01	10.08	3.95	16.08	0.98	22.08	0.58
4.17	1.04	10.17	3.79	16.17	0.97	22.17	0.58
4.25	1.06	10.25	3.63	16.25	0.96	22.25	0.57
4.33	1.08	10.33	3.49	16.33	0.95	22.33	0.57
4.42	1.11	10.42	3.36	16.42	0.94	22.42	0.57
4.50	1.13	10.50	3.24	16.50	0.93	22.50	0.56
4.58	1.16	10.58	3.13	16.58	0.93	22.58	0.56
4.67	1.19	10.67	3.02	16.67	0.92	22.67	0.56
4.75	1.22	10.75	2.92	16.75	0.91	22.75	0.55
4.83	1.25	10.83	2.83	16.83	0.90	22.83	0.55
4.92	1.28	10.92	2.75	16.92	0.89	22.92	0.55
5.00	1.32	11.00	2.67	17.00	0.88	23.00	0.55
5.08	1.36	11.08	2.59	17.08	0.88	23.08	0.54
5.17	1.40	11.17	2.52	17.17	0.87	23.17	0.54
5.25	1.44	11.25	2.45	17.25	0.86	23.25	0.54
5.33	1.48	11.33	2.39	17.33	0.85	23.33	0.53
5.42	1.53	11.42	2.32	17.42	0.85	23.42	0.53
5.50	1.58	11.50	2.27	17.50	0.84	23.50	0.53
5.58	1.64	11.58	2.21	17.58	0.83	23.58	0.53

5.67	1.70	11.67	2.16	17.67	0.83	23.67	0.52
5.75	1.76	11.75	2.11	17.75	0.82	23.75	0.52
5.83	1.83	11.83	2.06	17.83	0.81	23.83	0.52
5.92	1.91	11.92	2.02	17.92	0.81	23.92	0.52
6.00	1.99	12.00	1.97	18.00	0.80	24.00	0.51

CALIB NASHYD (0002)	Area (ha)= 1.50	Curve Number (CN)= 88.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.12	

Unit Hyd Qpeak (cms)= 0.477

PEAK FLOW (cms)= 0.416 (i)
TIME TO PEAK (hrs)= 8.083
RUNOFF VOLUME (mm)= 69.456
TOTAL RAINFALL (mm)= 100.838
RUNOFF COEFFICIENT = 0.689

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0001)	Area (ha)= 20.71	
ID= 1 DT= 3.0 min	Total Imp(%)= 85.00	Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	17.60	3.11
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	371.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.050	0.52	6.050	2.08	12.050	1.93	18.05	0.79
0.100	0.52	6.100	2.12	12.100	1.92	18.10	0.79
0.150	0.52	6.150	2.18	12.150	1.89	18.15	0.79
0.200	0.53	6.200	2.26	12.200	1.87	18.20	0.78
0.250	0.53	6.250	2.29	12.250	1.86	18.25	0.78
0.300	0.54	6.300	2.41	12.300	1.82	18.30	0.78
0.350	0.54	6.350	2.46	12.350	1.81	18.35	0.77
0.400	0.54	6.400	2.55	12.400	1.78	18.40	0.77

0.450	0.54	6.450	2.65	12.450	1.76	18.45	0.77
0.500	0.55	6.500	2.70	12.500	1.75	18.50	0.76
0.550	0.55	6.550	2.87	12.550	1.72	18.55	0.76
0.600	0.55	6.600	2.94	12.600	1.71	18.60	0.76
0.650	0.56	6.650	3.07	12.650	1.69	18.65	0.75
0.700	0.56	6.700	3.22	12.700	1.67	18.70	0.75
0.750	0.56	6.750	3.30	12.750	1.66	18.75	0.75
0.800	0.57	6.800	3.56	12.800	1.63	18.80	0.74
0.850	0.57	6.850	3.66	12.850	1.62	18.85	0.74
0.900	0.58	6.900	3.86	12.900	1.60	18.90	0.74
0.950	0.58	6.950	4.11	12.950	1.58	18.95	0.73
1.000	0.58	7.000	4.23	13.000	1.57	19.00	0.73
1.050	0.59	7.050	4.67	13.050	1.55	19.05	0.73
1.100	0.59	7.100	4.85	13.100	1.54	19.10	0.72
1.150	0.60	7.150	5.21	13.150	1.52	19.15	0.72
1.200	0.60	7.200	5.67	13.200	1.51	19.20	0.72
1.250	0.60	7.250	5.89	13.250	1.50	19.25	0.72
1.300	0.61	7.300	6.78	13.300	1.48	19.30	0.71
1.350	0.61	7.350	7.17	13.350	1.47	19.35	0.71
1.400	0.62	7.400	7.96	13.400	1.45	19.40	0.71
1.450	0.62	7.450	9.06	13.450	1.44	19.45	0.70
1.500	0.63	7.500	9.61	13.500	1.43	19.50	0.70
1.550	0.63	7.550	12.05	13.550	1.41	19.55	0.70
1.600	0.64	7.600	13.36	13.600	1.40	19.60	0.69
1.650	0.64	7.650	15.97	13.650	1.39	19.65	0.69
1.700	0.65	7.700	20.72	13.700	1.38	19.70	0.69
1.750	0.65	7.750	23.09	13.750	1.37	19.75	0.69
1.800	0.66	7.800	38.91	13.800	1.35	19.80	0.68
1.850	0.66	7.850	56.87	13.850	1.34	19.85	0.68
1.900	0.67	7.900	92.77	13.900	1.33	19.90	0.68
1.950	0.67	7.950	185.78	13.950	1.32	19.95	0.67
2.000	0.67	8.000	232.22	14.000	1.31	20.00	0.67
2.050	0.68	8.050	118.26	14.050	1.29	20.05	0.67
2.100	0.69	8.100	101.29	14.100	1.29	20.10	0.67
2.150	0.69	8.150	67.39	14.150	1.28	20.15	0.66
2.200	0.70	8.200	52.46	14.200	1.27	20.20	0.66
2.250	0.70	8.250	45.00	14.250	1.26	20.25	0.66
2.300	0.71	8.300	32.92	14.300	1.24	20.30	0.66
2.350	0.71	8.350	30.47	14.350	1.24	20.35	0.65
2.400	0.72	8.400	25.56	14.400	1.23	20.40	0.65
2.450	0.73	8.450	22.31	14.450	1.22	20.45	0.65
2.500	0.73	8.500	20.68	14.500	1.21	20.50	0.65
2.550	0.74	8.550	17.26	14.550	1.20	20.55	0.64
2.600	0.75	8.600	16.42	14.600	1.19	20.60	0.64
2.650	0.75	8.650	14.74	14.650	1.18	20.65	0.64
2.700	0.76	8.700	13.46	14.700	1.17	20.70	0.64
2.750	0.77	8.750	12.82	14.750	1.17	20.75	0.64
2.800	0.78	8.800	11.32	14.800	1.15	20.80	0.63
2.850	0.78	8.850	10.92	14.850	1.15	20.85	0.63
2.900	0.79	8.900	10.11	14.900	1.14	20.90	0.63
2.950	0.80	8.950	9.46	14.950	1.13	20.95	0.63

3.000	0.80	9.000	9.13	15.000	1.13	21.00	0.62
3.050	0.81	9.050	8.32	15.050	1.11	21.05	0.62
3.100	0.82	9.100	8.09	15.100	1.11	21.10	0.62
3.150	0.83	9.150	7.63	15.150	1.10	21.15	0.62
3.200	0.84	9.200	7.24	15.200	1.09	21.20	0.61
3.250	0.84	9.250	7.04	15.250	1.09	21.25	0.61
3.300	0.86	9.300	6.54	15.300	1.08	21.30	0.61
3.350	0.86	9.350	6.39	15.350	1.07	21.35	0.61
3.400	0.87	9.400	6.10	15.400	1.07	21.40	0.61
3.450	0.88	9.450	5.84	15.450	1.06	21.45	0.60
3.500	0.89	9.500	5.71	15.500	1.05	21.50	0.60
3.550	0.90	9.550	5.37	15.550	1.04	21.55	0.60
3.600	0.91	9.600	5.27	15.600	1.04	21.60	0.60
3.650	0.92	9.650	5.07	15.650	1.03	21.65	0.60
3.700	0.93	9.700	4.89	15.700	1.02	21.70	0.59
3.750	0.94	9.750	4.80	15.750	1.02	21.75	0.59
3.800	0.96	9.800	4.56	15.800	1.01	21.80	0.59
3.850	0.96	9.850	4.48	15.850	1.01	21.85	0.59
3.900	0.97	9.900	4.34	15.900	1.00	21.90	0.59
3.950	0.99	9.950	4.20	15.950	0.99	21.95	0.58
4.000	0.99	10.000	4.14	16.000	0.99	22.00	0.58
4.050	1.01	10.050	3.95	16.050	0.98	22.05	0.58
4.100	1.02	10.100	3.90	16.100	0.98	22.10	0.58
4.150	1.04	10.150	3.79	16.150	0.97	22.15	0.58
4.200	1.05	10.200	3.68	16.200	0.96	22.20	0.57
4.250	1.06	10.250	3.63	16.250	0.96	22.25	0.57
4.300	1.08	10.300	3.49	16.300	0.95	22.30	0.57
4.350	1.09	10.350	3.45	16.350	0.95	22.35	0.57
4.400	1.11	10.400	3.36	16.400	0.94	22.40	0.57
4.450	1.12	10.450	3.28	16.450	0.94	22.45	0.56
4.500	1.13	10.500	3.24	16.500	0.93	22.50	0.56
4.550	1.16	10.550	3.13	16.550	0.93	22.55	0.56
4.600	1.17	10.600	3.09	16.600	0.92	22.60	0.56
4.650	1.19	10.650	3.02	16.650	0.92	22.65	0.56
4.700	1.21	10.700	2.96	16.700	0.91	22.70	0.56
4.750	1.22	10.750	2.92	16.750	0.91	22.75	0.55
4.800	1.25	10.800	2.83	16.800	0.90	22.80	0.55
4.850	1.26	10.850	2.80	16.850	0.90	22.85	0.55
4.900	1.28	10.900	2.75	16.900	0.89	22.90	0.55
4.950	1.31	10.950	2.69	16.950	0.89	22.95	0.55
5.000	1.32	11.000	2.67	17.000	0.88	23.00	0.55
5.050	1.36	11.050	2.59	17.050	0.88	23.05	0.54
5.100	1.37	11.100	2.57	17.100	0.87	23.10	0.54
5.150	1.40	11.150	2.52	17.150	0.87	23.15	0.54
5.200	1.43	11.200	2.47	17.200	0.86	23.20	0.54
5.250	1.44	11.250	2.45	17.250	0.86	23.25	0.54
5.300	1.48	11.300	2.39	17.300	0.85	23.30	0.53
5.350	1.50	11.350	2.37	17.350	0.85	23.35	0.53
5.400	1.53	11.400	2.32	17.400	0.85	23.40	0.53
5.450	1.57	11.450	2.29	17.450	0.84	23.45	0.53
5.500	1.58	11.500	2.27	17.500	0.84	23.50	0.53

5.550	1.64	11.550	2.21	17.550	0.83	23.55	0.53
5.600	1.66	11.600	2.19	17.600	0.83	23.60	0.53
5.650	1.70	11.650	2.16	17.650	0.83	23.65	0.52
5.700	1.74	11.700	2.13	17.700	0.82	23.70	0.52
5.750	1.76	11.750	2.11	17.750	0.82	23.75	0.52
5.800	1.83	11.800	2.06	17.800	0.81	23.80	0.52
5.850	1.86	11.850	2.05	17.850	0.81	23.85	0.52
5.900	1.91	11.900	2.02	17.900	0.81	23.90	0.52
5.950	1.97	11.950	1.99	17.950	0.80	23.95	0.51
6.000	1.99	12.000	1.97	18.000	0.80	24.00	0.51

Max.Eff.Inten.(mm/hr)=	209.00	********	
over (min)	6.00	9.00	
Storage Coeff. (min)=	4.18 (ii)	6.94 (ii)	
Unit Hyd. Tpeak (min)=	6.00	9.00	
Unit Hyd. peak (cms)=	0.23	0.15	
			TOTALS
PEAK FLOW (cms)=	7.28	1.23	8.322 (iii)
TIME TO PEAK (hrs)=	8.05	8.10	8.05
RUNOFF VOLUME (mm)=	98.84	63.23	89.94
TOTAL RAINFALL (mm)=	100.84	100.84	100.84
RUNOFF COEFFICIENT =	0.98	0.63	0.89

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0006)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0001):	20.71	8.322	8.05	89.94
	+ ID2= 2 (0002):	1.50	0.416	8.08	69.46
	ID = 3 (0006):	22.21	8.702	8.05	88.56

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

RESERVOIR(0004)| IN= 2---> OUT= 1 | DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
OVERFLOW IS OFF				
	0.0000	0.0000	0.6190	1.0474
	0.0480	0.2326	0.6740	1.1492
	0.0780	0.4844	0.8160	1.4686

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                        0.4080     0.7558   |   0.8580      1.5800

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      8.702      8.05      88.56
   OUTFLOW: ID= 1 (  0004)     22.210      0.709      8.90      88.49

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.15
                  TIME SHIFT OF PEAK FLOW         (min)= 51.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  1.2290

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 FINISH
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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  Output  filename:
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DATE: 11/18/2021                          TIME: 10:54:40

USER:
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COMMENTS: _____

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  ***********************************************
  ** SIMULATION : 10-year Storm                 **
  ***********************************************

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| CHICAGO STORM    |    IDF curve parameters: A=1574.382
| Ptotal= 54.75 mm |                          B=   9.025
--------------------                          C=   0.860
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    =  5.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.08    2.53 |  1.08   15.60 |  2.08    8.95 |  3.08    3.58
                0.17    2.71 |  1.17   25.83 |  2.17    7.96 |  3.17    3.41
                0.25    2.93 |  1.25   61.71 |  2.25    7.17 |  3.25    3.26
                0.33    3.19 |  1.33  162.47 |  2.33    6.51 |  3.33    3.12
                0.42    3.49 |  1.42   79.04 |  2.42    5.97 |  3.42    2.99
                0.50    3.87 |  1.50   44.47 |  2.50    5.51 |  3.50    2.88
                0.58    4.34 |  1.58   29.77 |  2.58    5.12 |  3.58    2.77
                0.67    4.94 |  1.67   21.95 |  2.67    4.77 |  3.67    2.67
                0.75    5.73 |  1.75   17.20 |  2.75    4.47 |  3.75    2.57
                0.83    6.83 |  1.83   14.05 |  2.83    4.21 |  3.83    2.49
                0.92    8.44 |  1.92   11.83 |  2.92    3.98 |  3.92    2.41
                1.00   11.00 |  2.00   10.20 |  3.00    3.77 |  4.00    2.33


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| CALIB            |
| NASHYD   (  0002)|   Area    (ha)=   1.50   Curve Number   (CN)= 88.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   0.477

     PEAK FLOW       (cms)=   0.203 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  28.937
     TOTAL RAINFALL   (mm)=  54.748
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RUNOFF COEFFICIENT = 0.529

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB		
STANDHYD (0001)	Area (ha)= 20.71	
ID= 1 DT= 3.0 min	Total Imp(%)= 85.00	Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	17.60	3.11
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	371.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.050	2.53	1.050	15.60	2.050	8.95	3.05	3.58
0.100	2.59	1.100	19.01	2.100	8.62	3.10	3.53
0.150	2.71	1.150	25.83	2.150	7.96	3.15	3.41
0.200	2.86	1.200	49.75	2.200	7.43	3.20	3.31
0.250	2.93	1.250	61.71	2.250	7.17	3.25	3.26
0.300	3.19	1.300	162.47	2.300	6.51	3.30	3.12
0.350	3.29	1.350	134.66	2.350	6.33	3.35	3.08
0.400	3.49	1.400	79.04	2.400	5.97	3.40	2.99
0.450	3.74	1.450	55.99	2.450	5.66	3.45	2.91
0.500	3.87	1.500	44.47	2.500	5.51	3.50	2.88
0.550	4.34	1.550	29.77	2.550	5.12	3.55	2.77
0.600	4.54	1.600	27.16	2.600	5.00	3.60	2.73
0.650	4.94	1.650	21.95	2.650	4.77	3.65	2.67
0.700	5.47	1.700	18.78	2.700	4.57	3.70	2.61
0.750	5.73	1.750	17.20	2.750	4.47	3.75	2.57
0.800	6.83	1.800	14.05	2.800	4.21	3.80	2.49
0.850	7.37	1.850	13.31	2.850	4.13	3.85	2.46
0.900	8.44	1.900	11.83	2.900	3.98	3.90	2.41
0.950	10.15	1.950	10.74	2.950	3.84	3.95	2.36
1.000	11.00	2.000	10.20	3.000	3.77	4.00	2.33

Max.Eff.Inten.(mm/hr)=		148.56	********	
over (min)		6.00	9.00	
Storage Coeff. (min)=		4.79 (ii)	7.96 (ii)	
Unit Hyd. Tpeak (min)=		6.00	9.00	
Unit Hyd. peak (cms)=		0.21	0.14	
				TOTALS
PEAK FLOW	(cms)=	4.72	0.56	5.200 (iii)

```
     TIME TO PEAK    (hrs)=       1.40         1.45          1.40
     RUNOFF VOLUME    (mm)=      52.75        25.43         45.92
     TOTAL RAINFALL   (mm)=      54.75        54.75         54.75
     RUNOFF COEFFICIENT   =       0.96         0.46          0.84


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    20.71   5.200     1.40    45.92
      + ID2= 2 (  0002):     1.50   0.203     1.42    28.94
        ================================================
        ID = 3 (  0006):    22.21   5.391     1.40    44.77

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      5.391      1.40       44.77
   OUTFLOW: ID= 1 (  0004)     22.210      0.399      2.35       44.71

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.40
                  TIME SHIFT OF PEAK FLOW         (min)= 57.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.7485

--------------------------------------------------------------------------------
================================================================================
=======================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
```

```
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```


***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

Output filename:
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DATE: 11/18/2021 TIME: 10:54:40

USER:

COMMENTS: _____

****
** SIMULATION : 25mm Storm **
****

| CHICAGO STORM |
| Ptotal= 25.05 mm |

IDF curve parameters: A= 538.850
B= 6.331
C= 0.809
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME	RAIN	TIME	RAIN	TIME	RAIN	TIME	RAIN

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	1.42	1.08	6.93	2.08	4.25	3.08	1.92
0.17	1.51	1.17	10.96	2.17	3.84	3.17	1.84
0.25	1.61	1.25	25.75	2.25	3.51	3.25	1.77
0.33	1.74	1.33	75.61	2.33	3.23	3.33	1.71
0.42	1.88	1.42	33.15	2.42	2.99	3.42	1.64
0.50	2.06	1.50	18.38	2.50	2.79	3.50	1.59
0.58	2.27	1.58	12.51	2.58	2.62	3.58	1.53
0.67	2.54	1.67	9.43	2.67	2.47	3.67	1.49
0.75	2.89	1.75	7.56	2.75	2.33	3.75	1.44
0.83	3.36	1.83	6.32	2.83	2.21	3.83	1.40
0.92	4.04	1.92	5.43	2.92	2.11	3.92	1.36
1.00	5.09	2.00	4.76	3.00	2.01	4.00	1.32

CALIB					
NASHYD (0002)	Area (ha)=	1.50	Curve Number (CN)=	88.0	
ID= 1 DT= 5.0 min	Ia (mm)=	5.00	# of Linear Res.(N)=	3.00	
	U.H. Tp(hrs)=	0.12			

Unit Hyd Qpeak (cms)= 0.477

PEAK FLOW (cms)= 0.040 (i)
TIME TO PEAK (hrs)= 1.500
RUNOFF VOLUME (mm)= 7.251
TOTAL RAINFALL (mm)= 25.047
RUNOFF COEFFICIENT = 0.289

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
STANDHYD (0001)	Area (ha)=	20.71			
ID= 1 DT= 3.0 min	Total Imp(%)=	85.00	Dir. Conn.(%)=	75.00	

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	17.60	3.11
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	371.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr

0.050	1.42	1.050	6.93	2.050	4.25	3.05	1.92
0.100	1.45	1.100	8.27	2.100	4.11	3.10	1.90
0.150	1.51	1.150	10.96	2.150	3.84	3.15	1.84
0.200	1.58	1.200	20.82	2.200	3.62	3.20	1.80
0.250	1.61	1.250	25.75	2.250	3.51	3.25	1.77
0.300	1.74	1.300	75.61	2.300	3.23	3.30	1.71
0.350	1.78	1.350	61.45	2.350	3.15	3.35	1.68
0.400	1.88	1.400	33.15	2.400	2.99	3.40	1.64
0.450	2.00	1.450	23.30	2.450	2.86	3.45	1.61
0.500	2.06	1.500	18.38	2.500	2.79	3.50	1.59
0.550	2.27	1.550	12.51	2.550	2.62	3.55	1.53
0.600	2.36	1.600	11.48	2.600	2.57	3.60	1.52
0.650	2.54	1.650	9.43	2.650	2.47	3.65	1.49
0.700	2.77	1.700	8.19	2.700	2.38	3.70	1.46
0.750	2.89	1.750	7.56	2.750	2.33	3.75	1.44
0.800	3.36	1.800	6.32	2.800	2.21	3.80	1.40
0.850	3.59	1.850	6.02	2.850	2.18	3.85	1.38
0.900	4.04	1.900	5.43	2.900	2.11	3.90	1.36
0.950	4.74	1.950	4.99	2.950	2.04	3.95	1.33
1.000	5.09	2.000	4.76	3.000	2.01	4.00	1.32

Max.Eff.Inten.(mm/hr)=	56.74	********	
over (min)	6.00	12.00	
Storage Coeff. (min)=	7.04 (ii)	11.36 (ii)	
Unit Hyd. Tpeak (min)=	6.00	12.00	
Unit Hyd. peak (cms)=	0.17	0.10	
			TOTALS
PEAK FLOW (cms)=	1.89	0.10	1.946 (iii)
TIME TO PEAK (hrs)=	1.40	1.55	1.40
RUNOFF VOLUME (mm)=	23.05	6.43	18.89
TOTAL RAINFALL (mm)=	25.05	25.05	25.05
RUNOFF COEFFICIENT =	0.92	0.26	0.75

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0006)|				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0001):	20.71	1.946	1.40	18.89
+ ID2= 2 (0002):	1.50	0.040	1.50	7.25
ID = 3 (0006):	22.21	1.981	1.40	18.11

```
     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      1.981      1.40      18.11
   OUTFLOW: ID= 1 (  0004)     22.210      0.061      4.05      18.05

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.10
                  TIME SHIFT OF PEAK FLOW         (min)=159.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.3445

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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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43c73d1-c34d-4726-8f8a-4355dcd19201\
  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\5
43c73d1-c34d-4726-8f8a-4355dcd19201\
```

DATE: 11/18/2021 TIME: 10:54:39

USER:

COMMENTS: _____

**** SIMULATION : 25-year Storm **

| CHICAGO STORM |
| Ptotal= 64.46 mm |

IDF curve parameters: A=2019.372
B= 9.824
C= 0.875
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.78	1.08	18.53	2.08	10.41	3.08	4.00
0.17	2.99	1.17	31.05	2.17	9.22	3.17	3.81
0.25	3.24	1.25	74.37	2.25	8.27	3.25	3.63
0.33	3.54	1.33	190.82	2.33	7.48	3.33	3.47
0.42	3.90	1.42	95.08	2.42	6.83	3.42	3.32
0.50	4.34	1.50	53.76	2.50	6.28	3.50	3.18
0.58	4.89	1.58	35.88	2.58	5.81	3.58	3.06
0.67	5.60	1.67	26.31	2.67	5.41	3.67	2.94
0.75	6.54	1.75	20.49	2.75	5.05	3.75	2.83
0.83	7.86	1.83	16.63	2.83	4.74	3.83	2.74
0.92	9.80	1.92	13.93	2.92	4.47	3.92	2.64
1.00	12.91	2.00	11.93	3.00	4.22	4.00	2.56

| CALIB |
| NASHYD (0002)| Area (ha)= 1.50 Curve Number (CN)= 88.0
|ID= 1 DT= 5.0 min | Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.12

Unit Hyd Qpeak (cms)= 0.477

```
     PEAK FLOW       (cms)=   0.269 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  37.074
     TOTAL RAINFALL   (mm)=  64.464
     RUNOFF COEFFICIENT   =   0.575

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  20.71
|ID= 1 DT= 3.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  75.00
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      17.60         3.11
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     371.57        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   3.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.050    2.78 | 1.050   18.53 | 2.050   10.41 |  3.05    4.00
              0.100    2.85 | 1.100   22.71 | 2.100   10.02 |  3.10    3.94
              0.150    2.99 | 1.150   31.05 | 2.150    9.22 |  3.15    3.81
              0.200    3.16 | 1.200   59.93 | 2.200    8.58 |  3.20    3.69
              0.250    3.24 | 1.250   74.37 | 2.250    8.27 |  3.25    3.63
              0.300    3.54 | 1.300  190.82 | 2.300    7.48 |  3.30    3.47
              0.350    3.66 | 1.350  158.90 | 2.350    7.26 |  3.35    3.42
              0.400    3.90 | 1.400   95.08 | 2.400    6.83 |  3.40    3.32
              0.450    4.19 | 1.450   67.53 | 2.450    6.46 |  3.45    3.23
              0.500    4.34 | 1.500   53.76 | 2.500    6.28 |  3.50    3.18
              0.550    4.89 | 1.550   35.88 | 2.550    5.81 |  3.55    3.06
              0.600    5.13 | 1.600   32.69 | 2.600    5.68 |  3.60    3.02
              0.650    5.60 | 1.650   26.31 | 2.650    5.41 |  3.65    2.94
              0.700    6.23 | 1.700   22.43 | 2.700    5.17 |  3.70    2.87
              0.750    6.54 | 1.750   20.49 | 2.750    5.05 |  3.75    2.83
              0.800    7.86 | 1.800   16.63 | 2.800    4.74 |  3.80    2.74
              0.850    8.51 | 1.850   15.73 | 2.850    4.65 |  3.85    2.70
              0.900    9.80 | 1.900   13.93 | 2.900    4.47 |  3.90    2.64
              0.950   11.87 | 1.950   12.60 | 2.950    4.31 |  3.95    2.59
              1.000   12.91 | 2.000   11.93 | 3.000    4.22 |  4.00    2.56

     Max.Eff.Inten.(mm/hr)=     174.86     ********
               over (min)        6.00          9.00
```

```
     Storage Coeff.  (min)=       4.49 (ii)    7.46 (ii)
     Unit Hyd. Tpeak (min)=       6.00         9.00
     Unit Hyd. peak  (cms)=       0.22         0.14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       5.67         0.76          6.335 (iii)
     TIME TO PEAK    (hrs)=       1.40         1.45           1.40
     RUNOFF VOLUME    (mm)=      62.46        32.85          55.06
     TOTAL RAINFALL   (mm)=      64.46        64.46          64.46
     RUNOFF COEFFICIENT   =       0.97         0.51           0.85


       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  74.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    20.71   6.335     1.40    55.06
     + ID2= 2 (  0002):     1.50   0.269     1.42    37.07
       ================================================
       ID = 3 (  0006):    22.21   6.588     1.40    53.84

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      6.588      1.40      53.84
   OUTFLOW: ID= 1 (  0004)     22.210      0.505      2.30      53.78

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.67
                  TIME SHIFT OF PEAK FLOW         (min)= 54.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.8905

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
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aad263c-bddf-47e9-ba49-bdb3eabe07cc\
  Summary filename:
C:\Users\dsredojevic\AppData\Local\Civica\VH5\551ceb7e-af91-4608-b756-d808521cc3ad\a
aad263c-bddf-47e9-ba49-bdb3eabe07cc\


DATE: 11/18/2021                          TIME: 10:54:40

USER:



COMMENTS: _____________________________________________________________


--------------------------------------------------------------------------------
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  ********************************************
  ** SIMULATION : 2-year                     **
  ********************************************


--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1290.000
| Ptotal= 44.94 mm |                          B=   8.500
--------------------                          C=   0.860
                       used in:   INTENSITY =  A / (t + B)^C
```

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.05	1.08	12.57	2.08	7.21	3.08	2.90
0.17	2.20	1.17	20.86	2.17	6.42	3.17	2.77
0.25	2.38	1.25	50.59	2.25	5.78	3.25	2.64
0.33	2.58	1.33	137.56	2.33	5.26	3.33	2.53
0.42	2.83	1.42	65.09	2.42	4.82	3.42	2.43
0.50	3.13	1.50	36.14	2.50	4.45	3.50	2.33
0.58	3.51	1.58	24.07	2.58	4.14	3.58	2.25
0.67	3.99	1.67	17.71	2.67	3.86	3.67	2.17
0.75	4.63	1.75	13.86	2.75	3.62	3.75	2.09
0.83	5.51	1.83	11.32	2.83	3.41	3.83	2.02
0.92	6.81	1.92	9.54	2.92	3.22	3.92	1.96
1.00	8.86	2.00	8.22	3.00	3.05	4.00	1.89

CALIB			
NASHYD (0002)	Area (ha)= 1.50	Curve Number (CN)= 88.0	
ID= 1 DT= 5.0 min	Ia (mm)= 5.00	# of Linear Res.(N)= 3.00	
	U.H. Tp(hrs)= 0.12		

Unit Hyd Qpeak (cms)= 0.477

PEAK FLOW (cms)= 0.145 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 21.105
TOTAL RAINFALL (mm)= 44.941
RUNOFF COEFFICIENT = 0.470

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB			
STANDHYD (0001)	Area (ha)= 20.71		
ID= 1 DT= 3.0 min	Total Imp(%)= 85.00	Dir. Conn.(%)= 75.00	

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	17.60	3.11
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	371.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.050	2.05	1.050	12.57	2.050	7.21	3.05	2.90
0.100	2.10	1.100	15.34	2.100	6.95	3.10	2.86
0.150	2.20	1.150	20.86	2.150	6.42	3.15	2.77
0.200	2.32	1.200	40.68	2.200	6.00	3.20	2.69
0.250	2.38	1.250	50.59	2.250	5.78	3.25	2.64
0.300	2.58	1.300	137.56	2.300	5.26	3.30	2.53
0.350	2.67	1.350	113.41	2.350	5.11	3.35	2.50
0.400	2.83	1.400	65.09	2.400	4.82	3.40	2.43
0.450	3.03	1.450	45.79	2.450	4.58	3.45	2.36
0.500	3.13	1.500	36.14	2.500	4.45	3.50	2.33
0.550	3.51	1.550	24.07	2.550	4.14	3.55	2.25
0.600	3.67	1.600	21.95	2.600	4.04	3.60	2.22
0.650	3.99	1.650	17.71	2.650	3.86	3.65	2.17
0.700	4.42	1.700	15.14	2.700	3.70	3.70	2.12
0.750	4.63	1.750	13.86	2.750	3.62	3.75	2.09
0.800	5.51	1.800	11.32	2.800	3.41	3.80	2.02
0.850	5.94	1.850	10.73	2.850	3.35	3.85	2.00
0.900	6.81	1.900	9.54	2.900	3.22	3.90	1.96
0.950	8.18	1.950	8.66	2.950	3.11	3.95	1.92
1.000	8.86	2.000	8.22	3.000	3.05	4.00	1.89

Max.Eff.Inten.(mm/hr)=	125.49	********	
over (min)	6.00	9.00	
Storage Coeff. (min)=	5.13 (ii)	8.51 (ii)	
Unit Hyd. Tpeak (min)=	6.00	9.00	
Unit Hyd. peak (cms)=	0.21	0.13	
			TOTALS
PEAK FLOW (cms)=	3.89	0.39	4.220 (iii)
TIME TO PEAK (hrs)=	1.40	1.45	1.40
RUNOFF VOLUME (mm)=	42.94	18.42	36.81
TOTAL RAINFALL (mm)=	44.94	44.94	44.94
RUNOFF COEFFICIENT =	0.96	0.41	0.82

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

ADD HYD (0006)				
1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)

```
        ID1= 1 (  0001):    20.71   4.220     1.40    36.81
      + ID2= 2 (  0002):     1.50   0.145     1.42    21.10
        ================================================
        ID = 3 (  0006):    22.21   4.356     1.40    35.75

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      4.356      1.40      35.75
   OUTFLOW: ID= 1 (  0004)     22.210      0.250      2.60      35.69

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.73
                  TIME SHIFT OF PEAK FLOW         (min)= 72.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.6256

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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


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  Output  filename:
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DATE: 11/18/2021 TIME: 10:54:39

USER:

COMMENTS: _____

****
** SIMULATION : 50-year Storm **
****

| CHICAGO STORM |
| Ptotal= 72.05 mm |

IDF curve parameters: A=2270.665
B= 9.984
C= 0.876
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 5.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	3.10	1.08	20.80	2.08	11.67	3.08	4.47
0.17	3.34	1.17	34.86	2.17	10.33	3.17	4.25
0.25	3.62	1.25	83.24	2.25	9.26	3.25	4.05
0.33	3.95	1.33	211.98	2.33	8.38	3.33	3.87
0.42	4.35	1.42	106.30	2.42	7.64	3.42	3.70
0.50	4.85	1.50	60.28	2.50	7.03	3.50	3.55
0.58	5.47	1.58	40.27	2.58	6.50	3.58	3.41
0.67	6.26	1.67	29.53	2.67	6.04	3.67	3.28
0.75	7.32	1.75	22.99	2.75	5.65	3.75	3.16
0.83	8.80	1.83	18.66	2.83	5.30	3.83	3.05
0.92	10.98	1.92	15.62	2.92	4.99	3.92	2.95
1.00	14.48	2.00	13.38	3.00	4.72	4.00	2.85

| CALIB |

```
| NASHYD   (  0002)|   Area    (ha)=   1.50   Curve Number   (CN)= 88.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   0.477

     PEAK FLOW       (cms)=   0.319 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  43.618
     TOTAL RAINFALL   (mm)=  72.046
     RUNOFF COEFFICIENT   =   0.605

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  20.71
|ID= 1 DT= 3.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  75.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      17.60         3.11
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     371.57        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   3.0 MIN. TIME STEP.


                        ---- TRANSFORMED HYETOGRAPH ----
      TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
       hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
     0.050    3.10 | 1.050   20.80 | 2.050   11.67 |  3.05    4.47
     0.100    3.18 | 1.100   25.48 | 2.100   11.23 |  3.10    4.40
     0.150    3.34 | 1.150   34.86 | 2.150   10.33 |  3.15    4.25
     0.200    3.53 | 1.200   67.11 | 2.200    9.62 |  3.20    4.12
     0.250    3.62 | 1.250   83.24 | 2.250    9.26 |  3.25    4.05
     0.300    3.95 | 1.300  211.98 | 2.300    8.38 |  3.30    3.87
     0.350    4.09 | 1.350  176.76 | 2.350    8.13 |  3.35    3.81
     0.400    4.35 | 1.400  106.30 | 2.400    7.64 |  3.40    3.70
     0.450    4.68 | 1.450   75.62 | 2.450    7.23 |  3.45    3.60
     0.500    4.85 | 1.500   60.28 | 2.500    7.03 |  3.50    3.55
     0.550    5.47 | 1.550   40.27 | 2.550    6.50 |  3.55    3.41
     0.600    5.73 | 1.600   36.69 | 2.600    6.35 |  3.60    3.37
     0.650    6.26 | 1.650   29.53 | 2.650    6.04 |  3.65    3.28
     0.700    6.97 | 1.700   25.17 | 2.700    5.78 |  3.70    3.20
     0.750    7.32 | 1.750   22.99 | 2.750    5.65 |  3.75    3.16
     0.800    8.80 | 1.800   18.66 | 2.800    5.30 |  3.80    3.05
     0.850    9.53 | 1.850   17.65 | 2.850    5.20 |  3.85    3.02
     0.900   10.98 | 1.900   15.62 | 2.900    4.99 |  3.90    2.95
```

```
              0.950   13.31 | 1.950   14.13 | 2.950    4.81 |  3.95    2.88
              1.000   14.48 | 2.000   13.38 | 3.000    4.72 |  4.00    2.85

    Max.Eff.Inten.(mm/hr)=     194.37     ********
              over (min)         6.00          9.00
    Storage Coeff.  (min)=       4.30 (ii)     7.15 (ii)
    Unit Hyd. Tpeak (min)=       6.00          9.00
    Unit Hyd. peak  (cms)=       0.23          0.14
                                                          *TOTALS*
    PEAK FLOW       (cms)=       6.37          0.93          7.185 (iii)
    TIME TO PEAK    (hrs)=       1.40          1.45           1.40
    RUNOFF VOLUME    (mm)=      70.05         38.89          62.26
    TOTAL RAINFALL   (mm)=      72.05         72.05          72.05
    RUNOFF COEFFICIENT   =       0.97          0.54           0.86


      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  74.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0006)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0001):    20.71   7.185     1.40    62.26
     + ID2= 2 (  0002):     1.50   0.319     1.42    43.62
       ================================================
       ID = 3 (  0006):    22.21   7.487     1.40    60.99

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      7.487      1.40       60.99
   OUTFLOW: ID= 1 (  0004)     22.210      0.586      2.30       60.94

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.83
```

```
                    TIME SHIFT OF PEAK FLOW         (min)= 54.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  1.0020

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================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2006)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                    *****  D E T A I L E D   O U T P U T *****


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DATE: 11/18/2021                          TIME: 10:54:39

USER:



COMMENTS: _____________________________________________________________


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  **********************************************
  ** SIMULATION : 5-year Storm                 **
  **********************************************

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```
| CHICAGO STORM    |    IDF curve parameters: A=1183.740
| Ptotal= 46.69 mm |                          B=   7.641
--------------------                          C=   0.838
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    =  5.00 min
                       Time to peak ratio =  0.33
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	2.36	1.08	13.04	2.08	7.70	3.08	3.27
0.17	2.52	1.17	21.19	2.17	6.90	3.17	3.12
0.25	2.71	1.25	50.66	2.25	6.25	3.25	2.99
0.33	2.93	1.33	141.24	2.33	5.72	3.33	2.87
0.42	3.19	1.42	65.17	2.42	5.27	3.42	2.76
0.50	3.51	1.50	36.21	2.50	4.89	3.50	2.66
0.58	3.91	1.58	24.34	2.58	4.56	3.58	2.56
0.67	4.41	1.67	18.09	2.67	4.27	3.67	2.48
0.75	5.07	1.75	14.31	2.75	4.02	3.75	2.40
0.83	5.98	1.83	11.80	2.83	3.80	3.83	2.32
0.92	7.29	1.92	10.03	2.92	3.60	3.92	2.25
1.00	9.36	2.00	8.71	3.00	3.43	4.00	2.18

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0002)|   Area    (ha)=   1.50   Curve Number   (CN)= 88.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.12

     Unit Hyd Qpeak  (cms)=   0.477

     PEAK FLOW       (cms)=   0.152 (i)
     TIME TO PEAK    (hrs)=   1.417
     RUNOFF VOLUME    (mm)=  22.470
     TOTAL RAINFALL   (mm)=  46.694
     RUNOFF COEFFICIENT   =   0.481

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  20.71
|ID= 1 DT= 3.0 min |   Total Imp(%)=  85.00   Dir. Conn.(%)=  75.00
--------------------

                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      17.60         3.11
     Dep. Storage     (mm)=       2.00         5.00
```

Average Slope	(%)=	1.00	2.00
Length	(m)=	371.57	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 3.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.050	2.36	1.050	13.04	2.050	7.70	3.05	3.27
0.100	2.41	1.100	15.76	2.100	7.44	3.10	3.22
0.150	2.52	1.150	21.19	2.150	6.90	3.15	3.12
0.200	2.64	1.200	40.84	2.200	6.47	3.20	3.04
0.250	2.71	1.250	50.66	2.250	6.25	3.25	2.99
0.300	2.93	1.300	141.24	2.300	5.72	3.30	2.87
0.350	3.02	1.350	115.89	2.350	5.57	3.35	2.83
0.400	3.19	1.400	65.17	2.400	5.27	3.40	2.76
0.450	3.40	1.450	45.87	2.450	5.02	3.45	2.69
0.500	3.51	1.500	36.21	2.500	4.89	3.50	2.66
0.550	3.91	1.550	24.34	2.550	4.56	3.55	2.56
0.600	4.08	1.600	22.26	2.600	4.47	3.60	2.54
0.650	4.41	1.650	18.09	2.650	4.27	3.65	2.48
0.700	4.85	1.700	15.57	2.700	4.11	3.70	2.42
0.750	5.07	1.750	14.31	2.750	4.02	3.75	2.40
0.800	5.98	1.800	11.80	2.800	3.80	3.80	2.32
0.850	6.42	1.850	11.21	2.850	3.74	3.85	2.30
0.900	7.29	1.900	10.03	2.900	3.60	3.90	2.25
0.950	8.67	1.950	9.15	2.950	3.49	3.95	2.21
1.000	9.36	2.000	8.71	3.000	3.43	4.00	2.18

Max.Eff.Inten.(mm/hr)=	128.56	********		
over (min)	6.00	9.00		
Storage Coeff. (min)=	5.08 (ii)	8.43 (ii)		
Unit Hyd. Tpeak (min)=	6.00	9.00		
Unit Hyd. peak (cms)=	0.21	0.13		
			TOTALS	
PEAK FLOW (cms)=	3.98	0.41	4.324 (iii)	
TIME TO PEAK (hrs)=	1.40	1.45	1.40	
RUNOFF VOLUME (mm)=	44.69	19.63	38.43	
TOTAL RAINFALL (mm)=	46.69	46.69	46.69	
RUNOFF COEFFICIENT =	0.96	0.42	0.82	

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 74.0 Ia = Dep. Storage (Above)

(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.

(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------
| ADD HYD  (  0006)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):    20.71   4.324     1.40    38.43
      + ID2= 2 (  0002):     1.50   0.152     1.42    22.47
        ================================================
        ID = 3 (  0006):    22.21   4.467     1.40    37.35

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.6190      1.0474
                          0.0480     0.2326   |   0.6740      1.1492
                          0.0780     0.4844   |   0.8160      1.4686
                          0.4080     0.7558   |   0.8580      1.5800

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0006)     22.210      4.467      1.40      37.35
   OUTFLOW: ID= 1 (  0004)     22.210      0.271      2.60      37.29

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.06
                  TIME SHIFT OF PEAK FLOW         (min)= 72.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.6428

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Appendix F

Stage-Storage-Discharge Relationship and Drawdown Calculations

PROJECT- 49549-100 (Dorchester , ON)

Name: PRELIMINARY WET POND

Date : December, 2021

POND STORAGE AND DISCHARGE

Orifice #1(Plate)	
Orifice Invert Elevation	276.00m
Diameter of Orifice	225mm
Orifice Constant	0.63

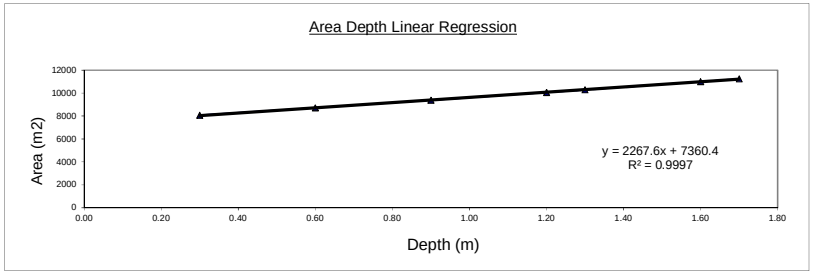
Orifice #2(Pipe)	
Orifice Invert Elevation	276.43m
Diameter of Orifice	575mm
Orifice Constant	0.63

Orifice #3(Pipe)	
Orifice Invert Elevation	0.00m
Diameter of Orifice	0mm
Orifice Constant	0.63

Weir(Trapezoidal)	
Weir Invert Elevation	196.50m
Bottom Length	10.00m
Side Slope (X:1)	13:1

Elevation (m)	Area (m^2)	Volume (m^3)	Cum.Storage Volume (m^3)	Depth over Orifice (m)	Depth to Center of Orifice (m)	Infiltration m3/sec	Flow (m^3/sec)	Depth over Orifice (m)	Depth to Center of Orifice (m)	Flow (m^3/sec)	Depth over Orifice (m)	Depth to Center of Orifice (m)	Flow (m^3/sec)	Depth over Weir (m)	Weir Flow (m^3/sec)	Total Flow m^3
PERMANENT POOL																
275	5475	0	0													
276	7440	6458	6458													
ACTIVE STORAGE																
276	7440	0	0	0.00	-0.11	0	-									
276.30	8068	2326	2326	0.30	0.19	0.000	0.048	-	-	-	-	-	-			**0.0481**
276.60	8715	2517	4844	0.60	0.49	0.000	0.078	0.17	-0.12	0.000						**0.0775**
276.90	9379	2714	7558	0.90	0.79	0.000	0.099	0.47	0.18	0.310						**0.4082**
277.20	10062	2916	10474	1.20	1.09	0.000	0.116	0.77	0.48	0.504						**0.6193**
277.30	10293	1018	11492	1.30	1.19	0.000	0.121	0.87	0.58	0.553						**0.6742**
277.60	11000	3194	14686	1.60	1.49	0.000	0.135	1.17	0.88	0.681						**0.8164**
277.70	11239	1112	15798	1.70	1.59	0.000	0.140	1.27	0.98	0.719						**0.8584**

VO2 Rating Table Input	
$Q(m^3/s)$	Store(ha.m)
0	0
0.048	0.2326
0.078	0.4844
0.408	0.7558
0.619	1.0474
0.674	1.1492
0.816	1.4686
0.858	1.5798



EXTENDED DETENTION ONLY				
Intercept of Regression, C3			7371.00	
Slope of Regression, C2			2252.700	
Extended Det. Ponding Elevation (O1)			276.43	m
Depth over Orifice			0.430	m
Orifice Area			0.0398	m^2
Drawdown Time	=		92.244	sec
	=		25.62	hr

[Drawdown time Equation is Eqn 4.11 Stormwater Management Planning and Design Manual MOE, March 2003]